Motivations to Upload and Tag Images vs. Tagging Practice: An Investigation of the Web 2.0 Site Flickr

Emma Stuart B.A. (hons)

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* Angus is the PhD candidate's maiden name.

Abstract

Digital images are being created and uploaded online in large numbers and this can be attributed to three main interconnected factors: a change in attitudes towards photography and its role in society; technological advancements in the camera industry; and changes in web technology. Many of these digital images are being uploaded to Flickr, one of the most popular of the new web 2.0 image management and sharing applications. Flickr supports secure storage, sharing, online communities, and tagging. Tagging is intended to aid with the organisation, description, and retrieval of images, and as tagging in Flickr generally relates to personal images (e.g., photographs), the tags assigned are highly subjective. Previous research has investigated motivations to upload and tag images in web 2.0 image management and sharing applications, and types of tags used in web 2.0 image management and sharing applications, and a limited number of studies have attempted to correlate the two, however no research has attempted to correlate the two whilst also taking into account the subjective nature of image tagging. Identifying the discrepancies between why people want to use Flickr, and how they use it can help system designers and users to get the best out of these applications. This thesis compares users' motivations to upload and tag their images in Flickr with how they tag their images in practice. The study used a quantitative survey methodology consisting of a semi-structured questionnaire to explore user motivations. Tagging practices were investigated via a manual tag classification scheme applied to automatically extracted Flickr tags. The questionnaire results show that Flickr users are primarily motivated to upload their images to Flickr for the purposes of social-communication (i.e., to draw attention to their images for comments and feedback and to express and present aspects of their personality and identity) and for social-organisation (i.e., so other people can access and view the images uploaded). However, tagging images in Flickr is not associated with the motivation of social-organisation and is instead more closely aligned to social-communication, and self-organisation (i.e., as a way of organising images for personal search and retrieval). Self-communication (i.e., documenting and recording for memory and personal reflection) was not found to be a popular motivation for either uploading or tagging images. Flickr users that are motivated to upload their images for the purposes of self-organisation have the clearest tagging practice and they predominantly use tags that are only meaningful to themselves. Gender, pro account status, number of images, and number of contacts are also strong predictors of

tagging practice. However, overall, tagging practice is more closely associated with image content than with the motivation the user has. Although the results show that social-communication is the most prominent factor in motivating users to upload their images and in motivating users to tag their images, the findings reveal that users who are motivated to upload their images for the purposes of social-organisation are not using the system to its full potential.

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Key terminology

Web 2.0 images & online image management and sharing applications

The term web 2.0 is used to refer to a perceived fundamental change in the way that people now interact with and share information online. Consumers are now active participators and are uploading and creating their own user-generated content to websites as opposed to passively reading content on static pages (Anderson, 2007). This thesis is concerned with images that are uploaded to Flickr, one of the earliest examples of a web 2.0 site (Cox, 2008), and therefore the term web 2.0 image is used to refer to the user-generated nature of the images that are uploaded to Flickr and other similar sites. Flickr defines itself as an online photo management and sharing application (Flickr, 2009), however since users can upload digital image files to Flickr that aren't necessarily photographs (e.g., cartoons, illustrations, scans of artwork, graphs, maps etc.), and also since this thesis draws on the field of traditional image indexing, the term image will be used. Where the term photograph is used, it refers specifically to an image that has been taken with a camera, either digital or analogue.

1 General introduction

Images have always been an integral part of human culture and society, from early markings on cave walls, through to the plethora of digital images that can be found online today (Terras, 2008, p. 1). As Mitchell (1992, p. 19) states, 'humans have a voracious appetite for information in visual form, and the digital image has such overwhelming technical and economic advantages as a way of meeting this demand.' Indeed, in 2010 it was estimated that there were over 10 billion images on the World Wide Web (Rorissa, 2010), and a report by IDC Research in March 2010 predicted that over 124 billion photos will have been shared through social networks by 2013 (Evangelista, 2010). This mass influx of images onto the web seems to be the result of three main interconnected factors: a change in attitudes towards photography and its role in society; technological advancements in the camera industry; and changes in web technology. The shift from analogue to digital photography and the development of cameraphones has changed the way people capture and organise photographs, as well as their relationship to photography and the kinds of things people photograph. Changes in web technology and the emergence of web 2.0 platforms where users generate and upload their own content has made it much easier for people to upload and share their images on dedicated image management and sharing sites such as Flickr. Flickr is one of the earliest examples of a web 2.0 site (Cox, 2008), and tagging is a key function. Tagging is the assigning of keywords to images to aid with description, organisation, and retrieval (Macgregor & McCulloch, 2006).

It is important to understand why people are placing their images on sites such as Flickr, and it is also important to understand how people are tagging them, in order to determine what value the images have to both the users that upload them, their friends and family, the wider community, and also to the system designers that create and maintain such sites. This thesis therefore investigates why and how people are uploading and tagging their images on Flickr.

The rest of this chapter will discuss in more detail the historical factors that give context to the role and function of images within society, and the technological developments that have facilitated the growing prevalence of online images. The chapter concludes with the rationale for the research, the justification for why Flickr was chosen for an investigation

into web 2.0 images and tagging, the overall approach taken, the aims and objectives, and the contribution to knowledge that this thesis provides.

1.1 Background

1.1.1 The role and function of images

Humans began creating images approximately 40,000 years ago, long before the written word, with pictorial representations of daily life made on rocks and cave walls (Feather, 2000, p. 11). Whether humans did this for religious, social, or merely artistic purposes is not clear, but whatever their purpose was, they represent humans' first known attempts at visual communication (O'Grady & O'Grady, 2008, p. 28) and illustrate that the part of the human brain that processes visual information is evolutionarily more developed than other parts of the brain (Harper, 2002). It was a further 36,000 years before the Egyptians developed the first alphabet in circa 2,000 B.C. as a writing method to convey sounds of words (Sacks, 2003, p. 3).

Visual experiences are important from an early age. For babies and young children, images play a crucial role in their comprehension of the world around them and their eyesight develops much faster than all the other senses. By about six to eight months old a baby's eyesight will be just as advanced as that of an adult's, and picture books and cartoons become an integral part of their lives. Babies build their experience upon a myriad of images and pictures, only later combining information from the spoken and written word (Berinstein, 1996, p. xxxi). Adults are less aware of the visual stimulus around them as they are often distracted by the complexities of daily life. As Jörgensen (2003, p. ix) aptly explains, 'Images have become ubiquitous, woven into our daily lives in such a way that we are often barely conscious of them.' Yet images have helped to structure the ways we see each other as men and women (Berger, 1972, p. 39).

The modern day understanding of what an image is encompasses a wide array of definitions. Images can be, 'pictures, statues, optical illusions, maps, diagrams, dreams, hallucinations, spectacles, projections, poems, patterns, memories, and even ideas' (Mitchell, 1984, p. 504). However, as this thesis is concerned with web 2.0 images, unless otherwise stated the term image will be used to refer to still digital images that have been

uploaded to online image management and sharing applications. Digital images can be defined as, 'a representation of an image stored in numerical form, for potential display, manipulation or dissemination via computer technologies' (Terras, 2008, p. 6). Digital images may originate from a number of different sources such as: analogue photographs or photographic slides/negatives, and 2D pictures/drawings/illustrations/paintings/maps/or diagrams that have been scanned and converted to digital files; they can be 'born digital' (Terras, 2008, p. 9), having been created in a digital format such as screenshots, or graphic design work/cartoons/illustrations/maps/layouts produced in computer software packages, and they can also be photographs that have been captured digitally via the use of digital cameras and cameraphones. As a result, vast collections of images now exist in organisations and institutions (Jörgensen, 2003, p. 1).

The pervasiveness of such an array of images and the increasing prevalence of images online has led to a claim that 'we are on the hinge of an important historical swing back towards what may be called the primacy of the image' (Jörgensen, 2003, p. ix).

1.1.2 Advancing photography and changing attitudes

1.1.2.1 From analogue to digital

Although images exist in many different formats, photography is accredited with beginning the revolution in visual information (Feather, 2000, p. 32). Before the mid-19th century, the replication of images was achieved by woodcuts, copper-plate engraving and lithography; all of these processes were time consuming and expensive and, unless carried out by people with years of experience, they could produce poor results. Then in 1839, after centuries of experimentation, photography was invented.

The French born Louis-Jacques-Mandé Daguerre, and the British born William Henry Fox Talbot are the two figures most notably accredited for establishing photography (Falconer & Hide, 2009, p. 9). Daguerre captured the first ever photo of a person, whom he caught whilst he was busy taking a 'daguerreotype' of a Paris street. However his daguerreotype process required a very long exposure time and movement resulted in very blurry images. This limited the kinds of things that could be photographed. Amongst the burgeoning middle classes, portrait photography became extremely popular, and often people had to be

'held' still in front of the camera with the aid of special rests in order to produce crisp images (Clarke, 1997, p. 15). These early cameras were 'cumbersome and expensive', seen as toys of 'the clever, the wealthy, and the obsessed' with only 'inventors and buffs' being able to operate them (Sontag, 1979, p.7). Each daguerreotype was also a unique image and reproductions were not possible (Clarke, 1997, p. 15). It is this factor that led to the daguerreotype soon being overtaken by the 'calotype' technique patented in 1841 by William Henry Fox Talbot. Talbot's technique involved a negative/positive process, meaning that multiple copies of an image could be made from a single negative. This process formed the basis of photography for the following century and a half (Falconer & Hide, 2009, p. 10).

In 1888 George Eastman's Kodak Company was formed, and thanks to new industrial processes, a small, portable and easy to use camera was created that could be mass-produced, thus making it more affordable and allowing for the adoption of photography by all classes of society (Clarke, 1997, p. 18). Amateur photography was born. The famous Kodak advertising slogan, 'you press the button, we do the rest', helped to cement Kodak's business model into the minds of the masses ensuring that they could simply 'point and shoot' their cameras and Kodak would take care of processing and developing, presenting the users with the final photographs in a neat display wallet. Kodak sold photography itself rather than just the camera and they could guarantee the amateur 'technically successful photos' (Slater, 1991, p. 52). Hence, as Sontag (1979, p. 24) famously stated, 'industrial societies turn their citizens into image junkies'.

The camera industry has once again changed dramatically within the last two decades with the switch from analogue to digital. Digital cameras started outselling analogue cameras in the United States in 2003 and worldwide by 2004 (Weinberger, 2007, p. 12). By 2011, 71% of UK households claimed to have a digital camera (compared to 51% in 2005) (Dutton & Blank, 2011, p. 13).

Digital cameras transformed the way people take, store, disseminate, and share images. Analogue cameras typically restricted picture taking to 24/36 shots per film, and films were then typically sent to specialised photo developers in order for the film to be processed and transformed into individual photographs. The advent of digital cameras changed this procedure completely. After the initial outlay for the cost of buying a digital

camera, its subsequent use is believed to be apparently 'free' since the costs of film and printing are no longer necessary and people are likely to already have hardware and digital devices for storing photos on. Digital cameras and their accompanying memory cards have the storage capacity to save thousands of images. The freedom of being able to take so many images has meant that people are much more prolific with digital cameras than they ever were with analogue (Rodden & Wood, 2003; Kirk et al., 2006; Richter & Schadler, 2009). This has also resulted in people taking more pictures of the same object or scene in the hope that one will turn out perfect (Kirk et al., 2006) as digital cameras provide immediate feedback on the quality of the captured image (Ritchin, 2009, p. 144). As a result, computers are becoming filled with thousands of photos (Weinberger, 2007, p. 12).

1.1.2.2 Cameraphones

The Japanese manufacturer Kyocera made the first phone with a built-in camera in July 1999, which was named the 'Visual Phone' (Goggin, 2006, p. 144). However, cameraphones were slow to gain acceptance for a number of reasons. Firstly, problems with standards across manufacturers meant that pictures sent via MMS (Multimedia Messaging Service) from one phone could not always be viewed on the recipient's phone (Economist, 2006). Secondly, picture messages were also much more expensive to send than normal text messages, typically costing four times as much (Economist, 2006) and the high costs put many people off from using the service (Biever & Reich, 2004). Lastly, the early cameraphones were also inferior to standalone digital cameras in terms of quality and functionality so people did not generally rely on their cameraphones for taking photographs at important events (Delis, 2010). It was predicted however that people would begin to make use of their cameraphones more when the quality of the camera reached 4-5 megapixels. The quality indeed increased, and the UK's first 5-megapixel cameraphone was released in 2006; by 2011 there were a number of cameraphones on the market with 12-megapixel inbuilt cameras (Clairmont, 2010) and at the beginning of 2012, Nokia announced the release of a 41-megapixel cameraphone (Swann, 2012). Phone service providers also began to improve the cross manufacturer standards and drastically cut the costs of picture messages (Ames et al., 2010). People slowly began to see new and novel ways that cameraphones could be utilised. In 2004, 150 million mobile phones with cameras were sold, almost four times the number of digital cameras (Weinberger, 2007, p. 12). By 2011, 67% of UK households were using their cameraphones to take pictures on

(compared to only 39% in 2005) and 53% were sending these photos to friends and family (compared to 44% in 2007) (Dutton, Helsper, & Gerber, 2009, p. 13).

Goggin (2006, p. 145) argues that the embeddedness of cameraphones in people's lives are making them a technology of everyday life. It is thanks to this embeddedness of the use of mobile phones in people's everyday lives that camerphones are once again changing the role of photography in society. Individuals can now carry their mobile phone (and thus their cameraphone) around with them everywhere they go, and there is a persistant vigilance to capture any perceived 'photo opportunity' (Okabe & Ito, 2003). The act of taking a photo was once reserved for rarefied moments of domestic life and 'special events' such as the family portrait, weddings, christenings and holidays (Murray, 2008), whereas photo taking now encompasses the more humorous (Meyer, 2008), mundane, fleeting, and unexpected moments found in everyday life (Okabe, 2004). Ito, Okabe and Matsuda (2005) define cameraphones as 'personal, portable, pedestrian' devices, and thus the function of the camera has shifted, allowing for the emergence of new photographic practices (Gye, 2007) and a new category of photography called 'ephemera' that seeks to locate beauty in the mundane (Murray, 2008).

The ubiquity of the cameraphone, and the ability to now easily share images via MMS has also given photography a more communicative function (Kindberg et al., 2005a, 2005b). As someone goes about their daily lives they may come across signs/objects/situations that remind them of a friend or loved one, and can quickly take a picture and send it. Okabe noted in 2004 that whereas the traditional camera tended to take on the role of a third party photographing people and scenes in a distanced way, the cameraphone seems to take on a more personal and individual viewpoint frequently being used to collect and archive fragments of everyday life (Okabe, 2004). Eight years on, the cameraphone is even more embedded in daily life (de Castella, 2012).

According to Sontag (1979, p. 24), 'Mallarmé said that everything in the world exists to end in a book. Today everything exists to end in a photograph.' This 1979 comment seems to be even truer in today's society. Many people now feel that they have to take photographs to prove that they have been somewhere or seen a particular sight or landmark (Chalfen, 1987, p. 101) and photos are used to validate our existence and experiences in the eyes of others.

1.1.2.3 Apps

Smartphones are owned by over a quarter of all adults and approximately half of the teenage population in the UK (Ofcom, 2011). Smartphones can perform an ever-expanding list of functions: as well as being able to make phonecalls, text, and take photographs, phones can now double up as media players, GPS navigation units, video cameras and web browsers. The key feature that sets them apart from standard mobile phones is that they are 'capable of running multiple programs or applications simultaneously much like a computer' (Nielsen, 2009). Apps are also a prominent feature of smartphones, and these are defined as, 'software programs that can interrogate a web server and present formatted information to the user' (White, 2010). Apps can be used to perform a wide range of tasks, including: checking the weather, searching for discount vouchers for nearby shops/eateries, or checking local travel information, all at the touch of a button or stylised screen icon. The term *app* is most closely associated with Apple's iPhone, as they were the first company that built a marketplace that monetised the concept of apps. However they are also now a prominent feature of the other main smartphone operating systems, namely, Android, Blackberry, Symbian, and Windows. Photography based apps are particularly popular at the moment and this is predominantly because they can transform a bad or boring photo into something more interesting and aesthetically pleasing (Palomba, 2011).

1.1.2.3.1 Old meets new: lomography and retro cameraphone apps

Photography apps are further consolidating the notion of ephemera photography. It is now often claimed that the future of photography is in cameraphone apps (Eler, 2012). Two of the most popular of the current photography apps are Instagram and Hipstamatic (Moore, 2012). Whilst these apps are specific to the Apple platform, other operating systems offer similar apps, and Instagram announced at the end of 2011 that they would be releasing a version for Android phones in the near future (Thakkar, 2011).

Tsotsis (2010) suggests that the popularity of such apps are due to three main reasons: firstly, the increased quality of cameras on mobile phones; secondly, the ease of use of such apps and because many different effects can be easily applied to images; and thirdly, the availability of a 3G internet connection on an increasing number of phones makes it easier for images to be uploaded and shared online.

Many of the effects that can be applied to images within the apps seek to replicate and pay homage to a recent resurgence in analogue photography called lomography. Lomography is an artistic style of photography that began to emerge in the early 1990s and now has a cult global following. Lomography originates from the rediscovery of cheaply manufactured analogue Russian cameras, most notably the Lomo Kompakt Automat (LC-A). The current users of such cameras are attracted by the grainy effects, the high colour saturation, and the outer edge vignetting that result in images with an arty and retro feel and such images become 'fetishized for their low-end look' (Murray, 2008). One of the core underlying goals of lomography is to remove the emphasis from the technology that is used and to instead place it on the final image that is created (Gerald, 2009).

However, technology soon comes back into the equation, and the Instagram and Hipstamatic cameraphone apps purport to, 'bring back the look, feel, unpredictable beauty, and fun of plastic toy cameras from the past' (Hipstamatic, 2011). Instagram directs users to, 'snap a photo with your iPhone, choose a filter to transform the look and feel, and send to Facebook, Twitter or Flickr – it's all as easy as pie' (Instagram, 2010). Apps such as these allow people to create lomo style retro images without needing to buy a lomo camera, and the images can be seamlessly shared online at the click of a button (akin to Kodak's slogan of 'you click the button and we do the rest'). Where George Eastman, founder of Kodak helped to democratise picture making and turned everyone into a photographer, apps such as Instagram and Hipstamatic are helping to make everyone into artists and once again eliminating a time consuming activity that could only be carried out by those trained to do so into an activity for the masses that can be done at the click of a button. As Harrison (2004, p. 24) points out, we are increasingly becoming interested in practices that are able to be performed by everyone. Due to the success of digital photography and cameraphones, the Kodak company filed for bankruptcy protection at the beginning of 2012, as it could no longer keep up with the changes taking place in the camera industry (BBC, 2012).

1.1.3 Advancing web technology

1.1.3.1 Web 2.0 and tagging

The term *web 2.0* was first coined in 2004 by O'Reilly Media during a conference brainstorming session. Dale Dougherty, web pioneer at O'Reilly Media and Tim O'Reilly, the Vice President, were discussing the dot-com bubble and realised that lots of new and exciting applications and sites kept emerging despite the fact that an apparent crash had happened (O'Reilly, 2005). They attempted to define the principles and practices that these successful sites had in common, and thus the term *web 2.0* was coined to mark the similarities between the sites that had successfully survived the dot-com crash. The term has come to be most closely associated with a fundamental change in the way that people now share information online (Stuart, 2009) via an ever-expanding list of websites that bring together the small contributions of millions of people (Grossman, 2006). These small contributions refer to a range of different resources such as: collaborative articles (Wikipedia); videos (YouTube); photos (Flickr); references (Delicious, CiteULike); music (Last.fm); and thoughts and ideas (Twitter, Blogger, WordPress). Social network sites (SNS) are also synonymous with web 2.0. Boyd and Ellison (2007) define SNSs as web-based services that allow individuals to construct a profile, define a list of other users with whom they share a connection, and be able to view and browse their list of connections as well as the connections of others within the system. Thelwall and Stuart (2010, pp. 265-266) give greater clarity to this definition by describing three distinct facets of SNSs: *Socializing SNSs* which 'support informal social interaction between members' (e.g., Facebook, MySpace); *Networking SNSs* which 'support non-social interpersonal communication' (e.g., LinkedIn, Mendeley); and (Social) *Navigation SNSs* which 'support finding resources via interpersonal connections' (e.g., Flickr, YouTube, Delicious). The authors also suggest that there are many SNSs that have elements of all three facets, even if their initial purpose was perhaps more specific. However, the term web 2.0 is a contested expression due to the fact it covers so many disparate ideas (Coleman & Levine, 2008, p. 85), and even the inventor of the web, Sir Tim Berners-Lee criticises it:

> *Web 2.0 is of course a piece of jargon, nobody even knows what it means. If web 2.0 for you is blogs and wikis, then that is people to people. But that was what the web was supposed to be all along. And in fact, you know, this 'web 2.0', it means using the*

> *standards which have been produced by all these people working on web 1.0. (Laningham, 2006)*

Much of the criticism of web 2.0 is based on the fact that the things that are being used to define web 2.0 – the blogs, wikis, social network sites – are all built on technology that was available in the 1990s (Black, 2007, p. 4). The terms *social media,* and *the social web* are now often used interchangeably alongside web 2.0 (Mandiberg, 2012, p. 4), however, they refer more narrowly to the specific social nature of communication, participation and collaboration of users online (Newson, Houghton, & Patten, 2009, p. 49) and in the active content creation process of users (Alexander & Levine, 2008), rather than the term web 2.0, which encompasses the overall shift in how technology 'that has existed since the 1990s' (to reiterate the words of Sir Tim Berners-Lee) is now being used in comparison to how it was previously being used. This is an important distinction for this thesis, which is concerned with why and how people are using the new technology platform Flickr, for the storing, organizing and sharing of their images. The emphasis here is placed on *why* people are using Flickr. No presumption is made at the outset that the reasons only centre on the social aspects of Flickr, as such a site can also be used for the private storage of images or for sharing only with very select people. Therefore this thesis will consistently use the term web 2.0 rather than social media or the social web when referring to image management and sharing applications, Flickr, and more generally to the new body of websites that now exist.

A feature that most web 2.0 sites have in common is the function for users to *tag* content, whether it is videos, images, blogs, or the site URL itself. Tagging is variously referred to as social tagging, collaborative tagging, and folksonomy (Macgregor & McCulloch, 2006; Trant, 2009). However, there are some subtle distinctions between the use of these interrelated terms that will be discussed in more detail in the literature review chapter. This thesis will use the term tagging throughout. The act of tagging is essentially the addition of freeform keyword(s) to information or content to aid with description, organisation, and subsequent retrieval (Nov, 2009). The act of tagging is similar to traditional keyword indexing (Chu, 2010, p. 30), with the main differences being the fact that the keyword(s) (i.e., the tags) are not drawn from a controlled vocabulary, and the tags are added by a combination of either the person who created or owns the content in question, or by users

of the system as a whole, whereas traditional indexing would have been performed by a trained classifier/indexer with subject specialist knowledge.

1.1.3.2 Flickr: blurring the boundaries between personal information management and resource sharing

Research carried out by the global market research company, YouGov, found that people in the UK are conscious of their digital photographs becoming lost due to ageing computers and hardware (Insider, 2009) and 'are increasingly shifting away from traditional desktop applications for managing all of their personal information and instead are using web 2.0 applications' (Norrie, 2008). Web 2.0 applications are therefore being used to both manage personal information and resources 'in the cloud', as well as to share selected information and resources with other people. The cloud is a metaphor that is generally used to refer to the 'storing, accessing, and sharing of data, applications, and computer power in cyberspace' (Anderson & Rainie, 2010). Thanks to this dual function that web 2.0 technology offers, web 2.0 applications are therefore becoming host to a rich variety of personal information (e.g., contacts, videos, photos, thoughts), and there is a blurring of the boundaries between Personal Information Management (PIM) and resource sharing (Heckner, Heilemann, & Wolff, 2009).

There are now many web 2.0 sites in existence, and people can share images via rich content sites such as Twitter, Tumblr, Posterous and Pinterest. However there are also a host of dedicated online image management and sharing applications in existence, including Flickr, Picasa, Photobucket, SmugMug, Shutterfly, and Photoshelter. The primary purpose of all of these applications is to give users a place where they can reliably store and archive their images as well as being able to easily share them with friends and family, potential clients, and even the public at large. Research by YouGov found that 83% of 18-24 year olds share their images on web 2.0 sites. The fact that more than half of the UK population also now has a phone that is capable of connecting to the internet via a 3G connection (Arthur, 2012) has further added to the growing rate with which images are being uploaded online. A recent report by Aimonetti (2011) revealed that the most popular camera being used amongst Flickr users is currently the iPhone camera. Indeed, Steve Jobs (co-founder of Apple Inc.) had set out to revolutionise three things with the advent of the

iPhone: television, textbooks, and photography (Messieh, 2011). The report by Aimonetti (2011) concluded that cameraphones are becoming increasingly more popular for the taking and uploading of images on Flickr.

1.2 Research problem

Technological advancements in the camera industry (i.e., the switch from analogue to digital and the development of cameraphones and dedicated photography apps) have changed people's attitudes towards photography and its role in society. At the same time, this has fuelled growth in the number of images that people capture, creating a digital deluge of images on people's home computers and cameraphones. However these advancements in the camera industry have been coupled with advancements in web technology. The emergence of web 2.0 services and dedicated image management and sharing applications such as Flickr have provided a perfect storage solution 'in the cloud' for people's ever expanding image collections whilst at the same time providing a platform for images to be easily shared with others. A prominent feature of many web 2.0 services is tagging, which is the addition of free-text keywords to resources to aid with description, categorisation, and subsequent retrieval of content. However such technology has created a blurring of the boundaries between PIM and resource sharing.

Useful web technology should align with users' motivations and actions. Different tagging practices may or may not be the result of the same motivations, and different motivations may or may not result in the same tagging practices; but useful technology should align with users' motivations and actions. System designers need to know about user behaviour in order to build better systems; therefore identifying the discrepancies between why people want to use Flickr, and how they use it will help system designers and users to get the best out of these applications.

Whilst the purpose of a website itself is said to be responsible for the kinds of tags that people will use in that site (Hammond et al., 2005), this is a somewhat simplistic view, and does not take into account that a site can have multiple purposes (i.e., Flickr can be used for secure storage as well as for social reasons) and purposes can change over time. Therefore users can potentially have a combination of different reasons for using a system, and thus a range of different reasons for tagging. Heckner, Heilemann and Wolff (2009)

assert that the underlying motivations of the user are likely to affect the tags that are used more than the website itself and whilst some studies have shown that the tags used can give an indication as to the motivation of the users (Körner et al., 2010; Strohmaier, Körner, & Kern, 2010; Kern, Körner, & Strohmaier, 2010; Zubiaga, Körner, & Strohmaier, 2011), this is only a limited view. As Heckner, Neubauer and Wolff (2008) assert, the interpretation of Flickr tags is difficult to achieve without also directly investigating users' intentions. Therefore the underlying motivations as to why somebody is using a website, and what they want to achieve from using that site, is a more appropriate way of investigating the kinds of tags that are used. Ultimately, understanding tagging behaviour is a key aspect in order to be able to improve websites (Farooq et al., 2007).

The research problem addressed in this thesis is to what extent motivation for uploading and tagging images in a web 2.0 image management and sharing application affects the overall nature of the tags that are used. However, an analysis of tags used in Flickr is confounded by the subjective nature of image interpretation and image indexing (Shatford, 1994), and tags taken out of context give no indication as to their true meaning or worth (Trant, 2009), therefore tags should not be looked at in isolation and instead should be analysed alongside their accompanying image.

1.3 Methods

1.3.1 Choice of Flickr

There are a host of image management and sharing applications available and the most widely known systems are currently: Flickr, Photobucket, Picasa, and SmugMug (Remick, 2010). However, Flickr is regarded as one of the earliest and most 'classic' examples of a web 2.0 site (Van House et al., 2005; Cox, 2008; Cox, Clough, & Siersdorfer, 2010), and was the first to make use of tagging (Smith, 2008, p. 9), which is not only a key element of this thesis, but now also an integrated part of image management and sharing applications. There is also an extensive body of Flickr research from which to draw upon (see literature review chapter) compared to Picasa, Photobucket and SmugMug, which have had very little academic research published on their use.

Whilst each of these systems could have nonetheless provided the basis from which to base this thesis on, there are a number of additional reasons why Flickr was chosen. These reasons will be discussed in parallel to what the other systems offer. Table 1-1 provides a broad overview of the features of each site including information such as account price, storage capacity, and global reach.

As Table 1-1 shows, the sites vary greatly in terms of account price, storage capacity and maximum image upload size allowed. These factors will no doubt impact upon which site particular users decide to use. A user on a tight budget who has a lot of large images that would like somewhere to store them as a backup is likely to opt for Picasa, as it offers the largest storage space and the largest individual image size upload out of the free options. However as this thesis is concerned with investigating user motivation it is necessary to pick the site that is likely to have the widest user base in order that the full gamut of potential motivations can be investigated, rather than just the motivation of users who wanted an online storage system for their images.

Whilst Photobucket appears to be the largest and most popular of the photosharing sites in terms of the amount of images contained on the site, with eight billion photos having been uploaded by December 2010 (BusinessWire, 2010), this can be attributed to the fact it is acknowledged as a photo hosting website rather than a photo sharing community (Prescott, 2007), where a smaller user-base are likely to be uploading large amounts of images for archiving. Flickr on the other hand is regarded as the most community orientated photo storage and sharing site (Remick, 2010) and it is this mix of photo storage facilities with social activity that makes Flickr so unique (Prieur et al., 2008). According to the web information company Alexa, as of 28th May 2011, Flickr had a global reach of 2.48000%, with the second most popular site being Photobucket with only a 0.94000% global reach. Global reach is defined by Alexa as, the percent of global internet users who visit a particular site. Whilst this also includes people who may just visit and browse the site rather than people who use the site to upload and tag their images, it nonetheless signifies Flickr's position as the most globally popular of the sites, and is therefore likely to have a more diverse and globally representative sample of users from which to base the investigation. Whilst the web traffic information taken from Alexa is not 100% accurate, it can be considered as sufficient to gain a snapshot view of a site's overall popularity (Thelwall, 2009, p. 91).

Table 1-1 Key features of image management and sharing applications

Image site	No. of images in the system	Way of contacting other users	Price	Storage capacity	Max image size	API	Global reach
Flickr	5 billion (as of September 2010)	Internal Flickrmail system as a way of contacting other users without having to disclose personal email addresses	Free account Pro account: $25 per year	Free accounts: 200 MB per month Pro accounts: unlimited storage	20MB	Yes	2.48000 (Alexa as of 28/05/11)
Photobucket	8 billion (as of December 2010)	Have to store as contacts before you can email other users	Free account Pro account: $24.95 per year	Free account: 500MB Pro account: unlimited storage	Free account: 1MB Pro account: 2MB	Yes	0.94000 (Alexa as of 28/05/11)
SmugMug	Not available	No internal mail system	Standard account: $40 per year Power account: $60 per year Pro account: $150 per year	Unlimited	Standard and Power accounts: 12 MB Pro account: 24MB	Yes	0.08500 (Alexa as of 28/05/11)
Picasa	Not available	No internal mail system	Free account Storage account: $5- $4096 per year	Free account: 1GB Storage account: $5: 20MB - $4096: 16TB	20MB	Deprecated	0.00021 (Alexa as of 28/05/11)

The availability of an Application Programming Interface (API) provides a way of being able to access and interact with the data contained in a website (Anderson, 2007) and this is useful for a large scale study of image and tag data. Whilst both Photobucket and SmugMug have active APIs, Flickr seems to provide the most comprehensive list of accompanying API documentation. Flickr also has an additional key feature which sets it apart from the other image sites, and that is its Flickrmail facility. Flickrmail is a built-in mail facility that allows private messages to be sent to other Flickr users without the need for personal email addresses to be disclosed or even for users to be classed as contacts of each other. This facility provides a perfect way of being able to contact and interact with such a global base of Flickr users.

1.3.2 Aims and objectives

Previous research has investigated motivations to upload and tag images in online image management and sharing applications, and also the types of tags used in web 2.0 image management and sharing applications, and a limited number of studies have attempted to correlate the two, however no research has attempted to correlate the two whilst also taking into account the subjective nature of image tagging. Therefore by drawing on image interpretation theory, the main aim of this thesis is to compare users' motivations to upload and tag their images in Flickr with how they tag their images in practice.

The main objectives are as follows:

1. To identify what motivates users to upload their digital images to Flickr
2. To identify what motivates users to tag their images in Flickr
3. To identify how users tag their images in Flickr
4. To identify what effect motivation to upload and tag has on the types of tags users assign to their images in Flickr

1.3.3 Overall approach

In order to identify user motivations to upload and tag in Flickr this study will utilise quantitative survey methodology consisting of a semi-structured questionnaire. The

questionnaire will make use of content and factor analysis in order to determine motivations for uploading and tagging images.

In order to investigate how Flickr users tag their images, system data will be extracted from Flickr via the use of the API. A tag classification scheme (developed in conjunction with the literature) will be used to manually classify the extracted image and tag data.

The results from the content and factor analyses will be compared to the results from the tag classification via the use of multinominal logistic regression in order to determine what effect motivation has on tagging practice.

1.3.4 Contribution to knowledge

Previous research has investigated motivations to take, upload, and tag images in web 2.0 image management and sharing applications, and the types of tags used in web 2.0 image management and sharing applications, and although some research has attempted to correlate tagging to user motivation, it has only done so by approximating motivation to statistical measures such as tag entropy, linguistic measures such as word class, and system measures such as number of images or group membership, measures that are ultimately detached from the meaning of tags or their relationship to the image they are attached to. No research has attempted to correlate user motivation in Flickr with tagging whilst also taking into account the subjective nature of image interpretation. It is this gap within the existing body of research on Flickr and image tagging that this thesis will fill, and this will be of benefit to the subject areas of image indexing/tagging, and photography and new media.

Whilst investigating user motivations and actions in the context of an online system could be broadly classed as human computer interaction (HCI), HCI from a computer science perspective generally focuses more closely on the technology itself, whereas HCI from an information science perspective focuses on the user and in understanding problems from the viewpoint of the user. For that reason, this work can draw parallels with the sub-field of HCI, personal information management (PIM), as PIM places more emphasis on the broader aspects of how people manage their information using a variety of both computer

and non computer based tools and this thesis will also advance the understanding of PIM within a web 2.0 environment.

1.4 Thesis structure

The literature review (chapter 2)

The literature review chapter is framed within the contexts of motivation, and tagging, and is structured in three main sections: the motivations behind capturing images; what motivates people to upload their images to Flickr; and tagging (covering both its likeness to traditional image indexing, and also what motivates Flickr users to tag their images).

The chapter will draw on literature from the fields of amateur and domestic photography, visual studies, HCI, image indexing and interpretation, and web 2.0.

The preliminary studies (chapter 3)

This chapter documents two previously published preliminary studies. The studies were designed to focus on tagging rather than aspects relating to the motivation for uploading and tagging in Flickr. There were two main purposes of these studies: firstly, to test the suitability of the Flickr API for extracting image and tag data; and secondly, to develop a suitable tag classification scheme that could be used in the principal investigation. Preliminary studies play a central role in information science and web based investigations as they enable an iterative process of determining the most effective methodology for the final investigation and also in determining the worth of such an investigation.

1. General patterns of tag usage among university groups in Flickr (Angus, Thelwall, & Stuart, 2008).

   The main focus of this investigation was in the development of a tag classification scheme for use with images and tags in Flickr that could be used to answer research objective no. 3 of the thesis.

2. Flickr's potential as an academic image resource: an exploratory study (Angus, Stuart, & Thelwall, 2010).

The main focus of this investigation was in testing content analysis methodology and in determining the value of Flickr beyond the context of amateur photography.

Research design (chapter 4)

Chapter 4 provides a rationalisation of the overall research design and sets out the research questions, hypotheses, and potential methods for execution.

Pilot study (chapter 5)

Chapter 5 reports on the rationalisation and findings of the pilot study. The pilot study was designed to test the use of a questionnaire for use in the principal investigation. This chapter therefore outlines the choice of survey-authoring software, question construction, wording, order, and overall design. The findings from the pilot study are presented along with a discussion and conclusion.

Principal methods and investigation (chapter 6)

Chapter 6 sets out the methods specific to the research objectives, explaining how data is collected and analysed in order to meet the objectives of the thesis investigation.

Results (chapter 7)

The results of the principal investigation are presented in chapter 7 and this is broken down into five main sections: general descriptive statistics; the results of the content, factor, and tag analyses that provide the answers to research questions 1 – 3; and inferential analysis via the use of multinominal logistic regression that provides the answer to research question 4 and also sub-questions 5 – 12.

Discussion (chapter 8)

Chapter 8 provides a detailed discussion of the findings from the principal investigation and outlines potential issues with both the methods used and the results that were obtained.

Conclusion (chapter 9)

This chapter amalgamates the findings from both the literature review and principal investigation in order to draw conclusions about what motivates users to upload and tag their images in Flickr and how these motivations affect tagging practice. The contribution

to knowledge is stated in terms of both the theoretical contributions and the practical applications of the research and these are caveated with the limitations of the investigation. Finally, avenues for further research are considered.

2 Literature review

2.1 Introduction

The general introduction explained the factors that have contributed to the growing number of digital images that are being created and placed online in dedicated image management and sharing applications. This literature review chapter will look more closely at the issues of motivation and tagging and will be split into three main sections. The first and second sections will look at issues surrounding the image itself (motivations for taking images, and motivations for uploading images online). The third section will focus on issues relating to tagging (the function of tagging, and motivations for tagging images). These themes will be discussed in a broad context drawing on a range of subject disciplines, with previous work that specifically focuses on Flickr being woven into the sections where appropriate.

2.2 Motivations for taking images

In an investigation into why people upload images to Flickr, and why and how such images are tagged, it is appropriate to look at why people take images in the first place (Van House et al., 2004). Flickr is different from a bookmarking site such as Delicious, as Flickr users are uploading personal content that has for the most part been created by themselves, compared to Delicious where users are saving links to resources that already exist on the web. This distinction means that the creation of the artefact (i.e., the image) is closely linked to what subsequently happens to it (Nov, Naaman, & Ye, 2009a). Therefore understanding why people take images will help to give context to the reasons behind why they then subsequently upload them to sites such as Flickr.

As the introduction chapter suggests, a plethora of different kinds of images exist within society. However it is the photographs that people have in their homes that are prized the most and they are often quoted as being the most important possession that people would want to save if their house was on fire (Greisdorf & O'Connor, 2002, p. 162; Van House et al., 2004; Van House et al., 2005). The majority of literature that investigates motivations for photography does so from the perspective of the amateur photographer who may be

using photography in either a primary sense (e.g., as a serious amateur hobbyist) who is interested in the practice of photography itself, or in a secondary sense (e.g., to take personal and family snapshots) where the person is more interested in using photography to capture memories from special events rather than in the actual practice of photography itself (Meyer, 2008). It is the latter form of photography that has been theorised the most and so much of the literature in this section will draw from the use of domestic photography, with literature from other genres of photography being added into the review where appropriate.

2.2.1 Photography (analogue and digital)

For decades, philosophers and art theorists have attempted to articulate and reason why humans are so preoccupied with taking photographs. Sontag (1979, p. 28) has said we photograph 'to confer importance and to aestheticize reality.' Barthes (2000, p. 14) has suggested we photograph things to drive them out of our minds. Bazin (1967, p. 14) has claimed 'we photograph to ward off death and the passing of time, by embalming time through photographs.'

When photography was first announced to the public in 1839, it was within the context of science that it was deemed to have the most potential due to a 'culture of scientific observation,' and Jean Baptiste Biot is thought to have described it as 'an artificial retina for physicists' (Wilder, 2009). Photographic methods were used in all scientific fields, from microscopy and physiology through to astronomy and physics.

However it was the advent of the Kodak Company in 1888 that sparked wider society's real desire to want to take pictures. Kodak developed the first mass produced portable camera that was relatively cheap and easy to use and therefore photography became accessible to people who would have previously never had the chance to operate a camera. Kodak keenly promoted capturing 'those special moments of domestic life' (Murray, 2008). West (2000) argues that Kodak also made photography popular in two additional ways: (1) Kodak removed the boredom that had once been associated with long sittings for portraiture photography and injected an element of play into the experience by allowing people to take their own portraits in informal poses and settings, and (2) they transformed images into commodities and taught amateur photographers to treat their experiences and

memories as objects of nostalgia (p. 1, & 8), offering consumers a way of being able to 'preserve' their memories so that they would never be forgotten (p. 9).

As well as photographing so that memories aren't forgotten, there is also the notion that photography is used to alter memories and make them more positive; a way of convincing ourselves in the future that the past was perfect (Holland & Spence, 1991, p. 43).

> *The children's party may bring tantrums, but the pictures will show laughter… the holiday may be spoilt by rain, but it will be sunny days that make it to the family album…non-conforming siblings and relatives are often left out of family photographs….and sickness and disease are barely visible (Holland & Spence, 1991, pp. 2, 7).*

We trick our future selves into thinking that the past was a happy time by contriving perfect scenarios and in then selecting snippets of images in order to create idealized versions of true events (Harrison, 2004, p. 37). Therefore we also photograph to forget as well as to remember (Holland & Spence, 1991, p. 9). Our preoccupation with creating idealized versions of the truth is further exacerbated thanks to digital imaging and the 'photoshop culture' (Richter & Schadler, 2009). Photojournalists and advertisers are often criticised for airbrushing and editing images and the truthful content of photographs is often under threat (Cohen, 2005). Although as Manovich (2003, p. 245) points out, to what extent has digital photography really altered the notion of 'truthfulness' considering that analogue images were often contrived versions of the truth. Truthfulness also often relies heavily on context. In June 2011, a digital image went viral of a young couple lying on the ground kissing amid riot police in Vancouver, Canada (Jones, 2011). Viewers of the image were shocked that the couple could be so carefree at a time of civil unrest. However, on interviewing the couple at a later date, it turned out that the girl had actually been knocked over by the riot police, and her boyfriend was comforting her and making sure she was ok. The true story behind the image was lost without the context of what had happened to the girl moments before the image had been captured.

The creation of 'idealized' versions of ourselves, and the truth, is closely linked to identity. We take portraits to 'fix our identity' (Bate, 2009, p. 67), and whilst in the past we were more likely to have our portraits taken by others, in recent years there has been a

significant rise in the self-portrait; people using digital cameras held at arms length in order to take a self picture. The popularity of the portrait in the 19th century led to what Tagg (1988) defined as 'the burden of representation'. Portraits ended up becoming a means of identification and this was especially unfavourable with people who did not want to be identified, such as criminals. This same burden can be seen in today's society, with many people concerned about their online identity and issues of privacy relating to the images they upload online (Ahern et al., 2007).

It was photography's close ties to science, as well as the democratization of picture taking (thanks to Kodak) that initially prevented it from being taken seriously as an art form. Art photographers were keen to separate themselves from 'average people' who took photographs, and they wanted to make sure that people could see what was 'special' about their work (Schwartz, 1986). In 1902, Alfred Stieglitz (a member of a camera club in New York) championed pictorialism. Pictorialism is a 'soft focus style of photography that emulated the surface characteristics of paintings or etchings' (Schwartz, 1986). Thus in making photographs that looked like paintings, Stieglitz illustrated photography's similarities with other fine art mediums. Essentially, art photographers are aiming to convey concepts and ideas with the images they make rather using the camera in order to make a reproduction of what they see with their eyes.

Photography still has close ties with science however, along with other professions such as policing. Meyer (2008) distinguishes between people who class themselves as photographers (amateur or professional), and those who merely have to use photography as a secondary practice as either part of their job (professional), or as part of the recognised practice of domestic and family photography (amateur). A person can fall into more than one category, but Meyer (2008) ultimately believes that a person's use of photography will be a driving force behind both their understanding and use of photographic technology and their expectations of how their images will be used.

2.2.2 Cameraphones

Whilst new photographic technologies altered the way that photographs were taken (as the first Kodak cameras did, as well as the switch to digital), new phone technologies have also begun to extend prior uses of photography (Gye, 2007; Ames et al., 2010). Such

extended uses can be seen perhaps most clearly in the realm of cameraphone images, where people are beginning to take images for new and novel reasons. Cameras can exist on standard mobile phones as well as on smartphones; the emphasis with smartphones however is their ability to interact with third-party software such as apps (Nielsen, 2009). The term cameraphone will be used here to place emphasis on the specific function of the camera element of the phone, regardless of whether it is a standard mobile phone or a smartphone.

With 67% of UK households owning a cameraphone (Dutton, Helsper, & Gerber, 2009, p. 13) people now have their cameraphones with them in a much wider variety of circumstances than they would have normally had their stand-alone cameras. This has altered peoples' perceptions of what is 'photoworthy' from significant moments and events such as birthdays, weddings, and christenings, to the more ordinary and transitory aspects of everyday life (Okabe & Ito, 2003; Okabe, 2004; Van House et al., 2005). The inconspicuous nature of cameraphones have also added to their ease of use and ability to capture atypical shots compared to SLR cameras that tend to attract more attention from passers by and they also take slightly longer to operate (Ames et al., 2010). This has resulted in the emergence of popular image content that has not frequently been seen with other kinds of cameras (Ames et al., 2010), and this new content has been labelled as a new kind of photography called 'ephemera' (Murray, 2008).

This new realm of photography has also been further extended due to the decreasing costs in MMS picture messaging (Ames et al., 2010), allowing communication to become more visual (David, 2010). The more recent high-speed web connectivity that smartphones enable has also encouraged images to be both shared and uploaded online more easily, adding to the communicational function of images.

There is a growing body of literature in the fields of HCI, software engineering and computer science that looks at why and how people are using cameraphones. Much of this work is conducted to provide practical recommendations for mobile imaging applications and to anticipate future uses of cameraphone technology, however, the work nonetheless provides some valuable insights to the question of why people are capturing images on their cameraphones.

Van House et al. (2004) interviewed 21 people to find out about their motivations for taking images on their cameraphones and using a grounded theory approach found that three main reasons emerged: 1. For constructing personal and group memory (people take images so they can remember things that they enjoyed or shared with others so that they can reminisce later) 2. Creating and maintaining social relationships (a way of being present with people who aren't physically present, and photos act as gifts too, they symbolically reinforce relationships) 3. Self-expression and self-presentation (these activities are related but different – self-expression is about using images to express a person's view of the world, and self-presentation is concerned with using images to try to influence how other people see them). The authors stress the importance of distinguishing between what someone does (i.e., sends a picture to a friend) and why they do it (i.e., in order to maintain the relationship with that person). This distinction is mirrored in this thesis and its aim to distinguish between motivations and actions (i.e., motivations to upload and tag images compared to how people tag images).

In the year following Van House et al.'s (2004) paper, Kindberg et al. (2005a) published an in-depth investigation into cameraphone use and whilst not making any reference to the work of Van House et al. (2004), put forward a taxonomy of both personal and social reasons as to why people capture images on their phones that seemed to both echo and enhance the work of Van House et al. (2004). The authors distinguished between *affective* (or sentimental) and *functional* intentions behind image capture, along the dimensions of *social* and *individual* intentions. *Social affective* intentions encompassed taking an image to enrich a mutual shared experience (e.g., taking photographs while with friends or family to keep as mementos of the experience), and/or taking an image with the intention of sharing it with someone who was not present at the time (e.g., taking a photo at a concert to share with someone who could not make it to the event). *Social functional* intentions encompassed images intended for sharing with people present at the time of capture in order to support a specific task (e.g., taking photographs at a workshop meeting to share with those who were present), and/or images intended to support a task with people remotely (e.g., photographing a particular hairstyle to show to a hairdresser at a later date). The authors also found a number of reasons relating to more personal activities. *Individual affective* intentions encompassed images taken for personal reflection and reminiscing (e.g., photographing something that signifies a personal achievement). *Individual*

functional intentions encompassed images taken with the intention to support a personal task (e.g., photographing gift ideas whilst out shopping).

From the 34 subjects that Kindberg et al. (2005a) interviewed (19 from the UK and 15 from the US), they found that two thirds of all of the images taken on the interviewees' cameraphones were captured for either social affective or social functional reasons. However participants were asked to show the interviewers a selection of images from their cameraphones and talk through why they took them. Such an approach is likely to suffer from a large amount of interviewer bias as it is likely that interviewees would be much more inclined to choose to talk to the interviewers about images that were originally intended for sharing anyway rather than ones that were potentially of a private nature or intended for personal reflection. It is therefore hard to be able to say with any certainty which category of motivation was the most popular. The interviewees also reported that they only shared images captured on their cameraphones with an average of 2.5 people. However this study was carried out when cameraphones were still relatively new and when sending picture messages relied on recipients having compatible phones (Economist, 2006). Cameraphones are now part of a wider nexus of smartphone capabilities, where images can be emailed or uploaded online directly from the phone itself or shared via one of the many social networking apps that are available. It would be interesting for Kindberg et al.'s (2005a) study to be replicated in light of current cameraphone technology. Whilst Van House et al. (2005) presented a follow up paper to their 2004 work in light of networked cameraphones, this work still predates the current capabilities of cameraphones, and the only new motivation they suggested in addition to their original paper was the taking of images for functional reasons, as had already been found by Kindberg et al. (2005a).

Cameraphones have added to photography in a number of ways. The communicative aspect of them has meant that a new instant sharing element to image taking has emerged, changing the communication landscape (David, 2010), and the 'always at hand' nature of cameraphones has also created a new form of image taking linked to personal tasks and reflection (Kindberg et al., 2005a, 2005b; Nov, Naaman, & Ye, 2007; Ames & Naaman, 2007). Cameraphones have also given rise to the emergence of new activities, which in turn are encouraging people to capture images for additional new purposes. The most discussed of these new activities are: citizenjournalism, moblogging, and sexting.

2.2.2.1 Citizenjournalism

Whilst the digital era gave rise to a feeling of distrust in the photographic image, the cameraphone image, is generally acknowledged for its truthfulness. Images and videos that are sent from mobile phones to news desks via MMS or by directly posting them online are increasingly being used by the mass media to report on events during times of tragedy and civil unrest. Due to the fact people have their cameraphones with them everywhere they go, there is often someone at hand to capture an important event as it happens, and it is this 'immediacy' factor that positions the images taken on a cameraphone as being 'newsworthy' (David, 2010). Cameraphone images are increasingly being involved in the breaking of news stories (David, 2010) and it was the cameraphone images sent from a passenger trapped on the underground system after the London tube bombings in 2005 that were the first images to be broadcast around the world (Ward, 2005).

There are dedicated Flickr groups for images relating to major disasters and incidents such the Indian Ocean earthquake and Tsunami in 2004, Hurricane Katrina in 2005, and the Virginia Tech shootings in 2007 (Liu et al., 2008). People ultimately take and share such images because they know other people will be eager to see 'true accounts' of what is happening and the images help to build a sense of collective community (Liu et al., 2008).

2.2.2.2 Photoblogging and moblogging

Photoblogging is the publishing of photo content in the form of blog posts (Cohen, 2005). Thanks to the rise of cameraphones and smartphone technology, moblogging has emerged, which refers to the emergent practice of posting content to blogs directly from a phone (Petersen, 2008). Photos are considered to be an often integral part of the blog structure (Cohen, 2005) and are often favoured as they take less effort to create than longer text based blog posts (Liu et al., 2008).

Van House et al. (2004) assert that photoblogging is becoming increasingly popular due to the combination of motivations it satisfies (memory, creating and maintaining relationships, self-expression). Women have been found to be particularly motivated to blog by the desire to communicate with others, whereas men blog more to share their

knowledge, expertise and opinions (Pedersen, 2010, p. 135). Cohen (2005) spoke to 30 self identified photobloggers and a common theme that emerged was the fact they enjoyed taking images specifically knowing that they were to go on their photoblogs. Thelwall (2006) distinguishes between externally-focused news-aware bloggers and internally-focused diary-like bloggers.

2.2.2.3 Sexting

Sexting is defined as 'sending sexually explicit photos by cellphone' (St George, 2009). Whilst the capturing of sexually explicit images for sharing with others (either known or unknown) both on and offline may be seen as nothing new, what is new here is the communicational aspect of such an act and its private one-to-one dynamic which makes it particularly infamous amongst teenagers that have cameraphones (Lenhart, 2009). The prevalence of sexting has led to many teenagers becoming the victims of bullying, when images they may have sent in confidence to a partner are then forwarded to other people without their consent. There have also been a number of teenagers arrested for charges of child pornography (BBC, 2009). This adds to the growing body of new activities that cameraphones are now being used for.

2.3 Motivation for uploading images

Meyer (2008) reports that people tend to take between 20-200% more images with digital cameras than they did with analogue, and whilst fewer are printed, more are now shared via email and websites. Computers have enabled new patterns of image distribution and dissemination (Bate, 2009, p. 157) and anyone with a digital camera and a computer with internet access (and even an analogue camera and a scanner) can upload images onto the computer's hard drive and online image management and sharing sites. Uploading has been further encouraged thanks to the prominence of cameraphones as many people fear that images will be lost when their phones are changed or upgraded and so there is a growing trend of uploading cameraphone images directly to sites such as Flickr (David, 2010). The most popular camera in use on Flickr at the current time is a smartphone (i.e., the iPhone) (Gross, 2010; Aimonetti, 2011), and 53% of UK households are said to post photos online (Dutton & Blank, 2011).

Not all images uploaded onto computers are done so with the intent to share or make public. Many people do so in order to create a backup system for their images, so that if a fire or flood destroys their physical counterparts, then a digital copy still remains. With digital photography, many people now do not bother to have photographs printed at all and are content with digital albums residing on their computers and external hard drives. Image management and sharing applications now allow for images to be stored online, away from the perceived vulnerability of a computer hard drive; after all, a house fire would also destroy a computer as well as the physical family photo album. So online image management and sharing applications offer an additional way of keeping images safe. Although people are still nonetheless worried about the long-term preservation and stability of using such outsourced services (Marshall, 2007).

Scholars of general motivation theory such as Harlow (1953) and Deci (1971, 1972) generally assert that there are three main drives that motivate people's behaviour: biological (e.g., the need to overcome hunger and thirst); rewards and punishment from the environment (e.g., working harder to receive a pay rise); and intrinsic motivation (e.g., the enjoyment gained from doing a particular activity/task). Deci and Ryan (1985) further extended the theories of motivation and asserted that behaviour can be driven by either intrinsic or extrinsic factors. Extrinsic motivations are underpinned by: the desire to achieve a separable outcome from one's actions (Ryan & Deci, 2000), such as improving skills (Lakhani & von Hippel, 2003), for example to gain comments and feedback from other Flickr users on how to improve photography skills and technique; enhancing professional status (Lakhani & Wolf, 2005), for example to use Flickr as a place to showcase photography work; or to build reputation within a community (Nov, Naaman, & Ye, 2009b), for example to share images with friends, family, or unknown contacts.. Intrinsic motivations are underpinned by the enjoyment from an activity as opposed to gaining in some way from the consequences of the activity (Ryan & Deci, 2000), for example uploading images to Flickr for the enjoyment of seeing one's favourite images presented together in one place. Pink (2011) reasons that intrinsic and extrinsic motivations are particularly pertinent in the web 2.0 environment, especially in light of websites such as Wikipedia, where volunteers contribute their time, information, and writing skills to add articles to the site for no financial reward, and instead are presumably driven by the enjoyment from imparting their knowledge (intrinsic motivation), or to improve their skills and build their reputation within the Wikipedia community (extrinsic motivation).

There is a lot of research that looks at user motivations for participating in online communities and research by Hargittai and Walejko (2008) found that males are much more likely to share content online than females. Skågeby (2012) however looks beyond such simple gender distinctions as to why people contribute to online communities, and instead argues that motivation is more closely directed by the specific contextual and social factors of the social mediating technologies that are in question. Of specific importance in social technology are the tensions between: social bonding and exchange (e.g., is the exchange of information/resources detrimental to online social relationships?), convergence and divergence (e.g., the different features that different sites offer), the use of emergent practices (e.g., unintended uses of social technology), and remediation and disruption (e.g., the similarities/differences with previous media forms). Skågeby (2012) suggests that the sharing of a photo in Flickr is of limited use and value to other users, and therefore social bonding with other users becomes the key motivator. However, as Nov, Naaman and Ye (2009a) point out, sites such as Flickr are very distinct from other web 2.0 sites and blogs; Flickr users are not creating content from scratch (as in a site like Wikipedia), they are merely uploading artefacts that already exist (i.e., photos). Nov, Naaman and Ye (2009a) assert that this distinction is likely to have implications related to motivations for contributing to and using sites because users essentially 'own' the content they upload to such sites, they will also be interested in managing and preserving such content, (as opposed to solely sharing it with others for the purposes of social bonding).

2.3.1 Personal information management and sharing (web 2.0 and non web 2.0)

Personal information management (PIM) refers to the 'methods and procedures by which we handle, categorize, and retrieve information' (Lansdale, 1988). Jones and Ross (2007) introduce the notion of a personal information collection (PIC) (such as a collection of digital images) as a subset of a personal space of information (PSI) (such as the Flickr interface) and claim that 'people want to have the right information in the right place, at the right time, in the right form' (Jones & Ross, 2007).

Whittaker, Bergman and Clough (2010) interviewed 18 parents regarding their digital family photo collections. Parents were also asked to undertake a series of retrieval tasks on

their home computers or laptops to establish how easy it was for them to locate images relating to specific events. 39% of those interviewed found they were unable to locate images on their computers, as they could not remember where exactly they had saved them. Participants subsequently commented that they thought their desktop photo archives were a mess and had no logical order. Many participants blamed this on the fact that they tend to take too many images now with digital cameras compared to analogue cameras, and hence they have too many images stored on their computers to efficiently organize them.

Utilising a combination of ethnographic field observations, interviews, and self-recording techniques, Frohlich et al. (2002) investigated the photo sharing practices of 11 families who owned Hewlett Packard digital imaging technology equipment. All 11 families reported that they enjoyed using the technology for being able to send photos to friends and family for remote sharing, as well as for partaking in co-present sharing. Co-present sharing allowed families to show off images to friends and family and relive enjoyable memories together or to help them experience a place or event where they hadn't been. The conversations that arose from the act of sharing their photos with others in this way was a big motivation for them to do so. Although the technology that the families were utilising in this investigation is now somewhat dated, their preferences for photo sharing nonetheless hold true in light of newer technology. Frohlich et al. (2002) even conclude by saying, 'future technology should help users in their socialization of digital photography products and services.'

Ames et al. (2010) carried out an empirical study looking at the cameraphone use of 26 participants over a 3-5 month period. Participants were given phones, access to online sites, software, and data plans, and the phones were equipped with an activity-logging tool that tracked what participants did on the phones. From the outset this is a very contrived environment, and having your phone activity logged is very likely to inhibit the activities that are carried out. It is also not clear whether or not the participants got to keep the phones they were given as part of the study, if they weren't allowed to keep them it may have affected how they used the phones. Knowing that it was only a temporary phone is likely to have either heightened activity relating to uploading images online, as participants would not have wanted to lose images that had value to them, or it is likely to have caused the participants to not utilise the phone as much as if it had been their permanent property.

It is therefore unsurprising that the authors did not find any new activities relating to cameraphone use. However, it is evident from the results of their investigation that cameraphones at this point were still not as advanced in terms of their coupling within a smartphone framework. This is illustrated by the authors reporting that some participants in their study found image uploading directly from the phone still to be a somewhat frustrating experience, although this was largely due to the cameraphone software that the participants were using; an application called ZoneTag. Nonetheless participants were keen to highlight the capabilities, stressing that being able to upload images directly from the phone allowed them to eliminate the daunting and time consuming task of first having to transfer images to a computer before being able to upload them online. However, the problems regarding the difficulty and time consuming nature of getting images off cameraphones (Van House et al., 2005) have largely been eased thanks to the ease with which images can now be uploaded directly online thanks to increased data plans and social sharing applications. This does not however take into account those people who take images on their cameraphones intended for personal use, but who nonetheless want to upload them to a secure place either on their computers or online. Although the Flickr app allows privacy levels to be specified on the phone at the time of upload, therefore images intended solely for personal use could just be uploaded to Flickr as private.

People have often found desktop applications for the management of their personal resources difficult to use (Kirk et al., 2006) and personal resources often become distributed between a variety of different hard drives, laptops, servers, and personal devices (Marshall, 2007). The development of web 2.0 technologies has created a major shift in how people manage their personal information. Many users are shifting away from the use of desktop applications for the storage and management of their personal image collections and are moving to the use of web 2.0 alternatives due to their convenience (Norrie, 2008). Web 2.0 image management and sharing applications provide a secure storage space in ‘the cloud’, where the responsibility of image backup is outsourced to the particular web service (e.g., Flickr), which allows people to access their images from wherever they have an internet connection. Such web services also act as a space for users to be able to interact and communicate with one another, thus providing additional social benefits.

Whilst some claim that Flickr is only used for either personal (Hammond et al., 2005), or social reasons (Prescott, 2007; Van House, 2007; Prieur et al., 2008), many other people claim that a site such as Flickr is used for both personal and social purposes (Dotan & Zaphiris, 2010; Lin & Faste, 2012) and a system should be encouraged to support the multiple reasons behind its use (Cool & Belkin, 2002). Focusing on the actual images that are uploaded to such sites, Koman (2005) asserts that photos that were traditionally private are now being shared with a global audience, whilst Lasén & Gómez-Cruz (2009) state that people are moving simultaneously between the public and the private.

In Heckner, Heilemann and Wolff's (2009) study which looked at whether users of web 2.0 systems use such platforms for the purposes of PIM or for information sharing, 48 Flickr participants were recruited from the Mechanical Turk service in order to complete a questionnaire. From qualitative judgements taken from free text comments, respondents that used Flickr showed a strong tendency towards information sharing with friends and family. However, in a quantitative section of the questionnaire, PIM and resource sharing came out as fairly equal, although PIM still played a big factor in their motivations. However the main concern with this study is the use of the Mechanical Turk service to recruit questionnaire participants. The service acts as a marketplace to recruit people to complete certain tasks for a small monetary payment. Therefore the people completing the tasks are more likely to be highly driven to complete a large number of different tasks so as to gain more payments, and this may have an adverse effect on the quality of the answers they give to questionnaire tasks.

Nov, Naaman and Ye (2009a, 2009b) in two similar studies, investigated the effect of two intrinsic and two extrinsic motivations for user participation on Flickr. In order to assess participation the authors extracted system data using the Flickr API, such as the number of images uploaded by a user, the number of unique tags the user had, the number of contacts, and the number of groups the user was a member of. These four factors were used as the dependent variables, and the authors correlated them with the results of survey data that was used to assess motivation. Based on a variety of previous work and literature sources, the authors looked at four different motivation factors: enjoyment, and commitment to the community (intrinsic motivation); self-development, and reputation (extrinsic). The authors found that users motivated by self-development (extrinsic) had a higher number of contacts, were a member of a higher number of groups, and had more unique tags. The

motivation of commitment (intrinsic) was positively related to the number of images posted, but negatively related to the number of unique tags and the number of groups a user was a member of. Nov, Naaman and Ye's (2009a, 2009b) two studies provide a useful insight into the importance of comparing user data (e.g., surveys) with system data (e.g., number of Flickr contacts and group membership) when looking at cause and effect relationships.

Whilst some of the research consulted in this literature review so far has focussed on analogue photography and other work has focussed on digital photography or the use of cameraphones, the emergent themes concerning both why people take images in the first place and also why they subsequently upload them online (either to a computer, a website, or an image management and sharing application) are centered around the core themes of memory and communication. Although changes in technology have altered people's actions (i.e., people can now use cameraphones to capture images and quickly send to friends and loved ones rather than photos having to be professionally developed and then presented in a family album), these different actions can nonetheless satisfy the same motives (i.e., constructing identity and communicating representations of ourselves to others) (Van House et al., 2004). Based on the prevalence of technological advancements there are a number of research papers that address the emerging social functions that images now have and whilst some papers focus solely on the use of cameraphones and others on the use of digital cameras, they are nonetheless situated within the overarching contexts of memory and communication.

Systems such as Flickr can provide an online file store for people's images where search and retrieval via the use of tags, sets, and collections of images can be utilised (Ames et al., 2010), and there is the suggestion that if people are interested in securely storing and organising their images then a site which has the option to make images public (even if the option is not utilised) could nonetheless put people off from using the system if that is their primary motivation for uploading images online (Ames et al., 2010). Also linked to the personal (or intrinsic) use of Flickr is its ability to act as a self-communicational tool such as a personal photo diary (Walker, 2005). It can be used as a method of assisting with the construction of personal memory (Van House et al., 2004) and photos from personal photography projects can be displayed online as a mechanism of provoking personal reflection. Nov, Naaman and Ye (2009b) also outline an intrinsic motivation that is

directed towards the self that focuses on the enjoyment of using a system. With regards to Flickr, this act of enjoyment is gained from the enjoyment a user experiences from sharing in an online community.

As Frohlich et al. (2002) found with the sharing of digital images prior to the emergence of systems such as Flickr, people are motivated by wanting to strengthen and maintain relationships with friends and family who are perhaps separated from them by geographic distance. This notion of wanting to strengthen and maintain relationships is echoed in the fact that photographs are often given as gifts (albeit usually in photo frames rather than online), but this demonstrates the power that personal photographs have as a means of being able to fulfil this need. This is also the case with sharing images on sites such as Flickr. Images of daily life are often shared as a way of letting someone know that they are 'included' in an event, despite the distance (Van House et al., 2005) or as a way of letting someone know they are being thought of (Ames et al., 2010). This can also be achieved in a more passive way, where images are uploaded online for friends and family to come across and browse as and when, as a way of 'staying in the loop' without necessarily having to be directly sent images (Lin & Faste, 2012). There is often a sense of obligation to organise photos for the benefits of friends, family, and future generations (Van House et al., 2004).

Photographs shared with others who were also present at the time of capture can be seen as a way of constructing group memory; reinforcing the shared experience and almost seeking to validate the good time that was had (Van House et al., 2004; Van House et al., 2005). This can be seen most clearly when images from family events such as birthday parties or weddings, or images from nights out with friends are shared and attendees then reminisce: 'I can't believe she wore that', 'I can't remember this being taken, I look so drunk!' Such conversations can take place either in person whilst viewing the images on screen or remotely via leaving comments and feedback attached to the photos online. As David (2010) summarises, such conversations are rooted in the visual.

Groups are an important feature of Flickr, fostering micro-communities among users and ensuring higher exposure for photos (Negoescu, 2008). Liu et al. (2008) found citizen journalism or disaster photos prevalent on Flickr with groups set up for all major events. Liu et al. (2008) found this was often so that people could share personal experiences and

support each other, and provide a place where people who are concerned can find out information, and help with recovery efforts. Whilst it is claimed that 50% of Flickr users never post images to a group (Negoescu & Gatica-Perez, 2008) they are nonetheless regarded as, 'one of the flagship features in Flickr' (Negoescu et al., 2009). Sharing images with groups is considered to be an important part of the image sharing practices of Flickr users (Negoescu & Gatica-Perez, 2008) and research by Negoescu et al. (2009) suggests that Flickr users like to self-organize in user communities via the use of groups. Holmes and Cox (2011) found that the activities of administrators and moderators in Flickr groups play a key role in the success of a group. However Dotan and Zaphiris (2010) suggest that, 'being a member of a large amount of groups may suggest less social and more self-promotion driven motives.' In light of this evidence, groups can be seen as an important feature in investigating user motivation for using Flickr. Similarly, Nov, Naaman and Ye (2008) argue that marking people as 'contacts' suggests a level of social presence. This is supported by Prieur et al. (2008) who claim that contacts are at the core of the sociality of Flickr because contacts give direct access to photos. Cox (2008) reasons that as Flickr encompasses all forms of photography, different types of photographers will have different reasons for using Flickr.

Additional investigation of relevant literature also suggested that the number of photos a user has is an indicator of their social presence (Nov, Naaman, & Ye, 2008). The use of pro accounts can also give insights into why people use Flickr. Dotan and Zaphiris (2010) state that, 'by its very definition, a pro (professional) account could be seen as targeting frequent users who wish to enjoy unlimited storage capacity.' Negoescu (2008) suggest that sharing behaviour may be influenced by the type of account a user has and they found that 69.79% of their sample of pro account users shared photos with groups compared to only 31.01% of non-pro account members. Although this could have been influenced by the constraints on a non-paying account such as photo uploads being limited to 200.

Cox, Clough, and Siersdorfer (2010) claim that Flickr's success is due to its combination of ego-centred activity and community aspects. This ego-centred aspect of Flickr is manifest in the fact that users can gain comments and feedback on their images, as well as receiving awards (Negoescu & Gatica-Perez, 2008; Cox, Clough, & Siersdorfer, 2010). This also positions Flickr as an ideal community for artists and both professional and semi-professional photographers to utilise as a space to exhibit and showcase their work and

create online galleries (Van House, 2007). However, Lerman, Plangprasopchok and Wong (2007) claim that the main reason for adding other Flickr users as contacts it to keep track of the work of other photographers who are of interest to them, rather than contacts being predominantly friends and family. The authors also claim that contacts in Flickr can be viewed as an expression of a user's motivation for using the service.

Linked to the premise of 'keeping track' of other photographers is the notion of self-development (Nov, Naaman, & Ye 2009a, 2009b) and the motivation of being able to learn from other photographers and learn new skills by viewing their work. Another version of this is uploading images so that other photographers and likeminded people can give feedback and constructive criticism on how images can be improved (Cox, Clough, & Marlow, 2008). There may be other instances where people want their images to be viewed by other people who are not necessarily personally known to them, and they are therefore uploading their images to gain exposure and have others view them. In this sense, Flickr acts as a virtual gallery space for people to exhibit their work (Van House, 2007). This motivation has been termed social signalling/attention by Nov, Naaman and Ye (2009a, 2009b). Whilst this motivation can be thought of as an intrinsic or self-based act in the sense that it is the image uploader who will benefit from any potential feedback and recognition of their work (Nov, Naaman, & Ye, 2009a, 2009b), it is nonetheless regarded as a social motivation by Nov, Naaman and Ye (2009a, 2009b) in the sense that the purpose of uploading is to encourage other people to see the images. Dotan and Zaphiris (2010) found that Flickr users from the UK and Iran are the most likely to be motivated to upload for this reason, although they didn't include the US, who make up the largest proportion of Flickr users. Cox, Clough, and Marlow (2008) found that some users even upload their images to Flickr selectively a few at a time rather than all at the same time as a way of trying to increase the feedback and comments that they receive.

Associated with photography's use in constructing identity and creating idealised versions of family life, is the motivation of uploading images for self-presentation. This is where images are used to influence other people's views of oneself (Goffman, 1990, p. 14), and to manage an online identity in an attempt to create an idealized version of themselves (Van House et al., 2004; Van House et al., 2005; Van House, 2007). Only carefully selected aspects of ourselves are uploaded so as to present ourselves in a more favourable light (Walker, 2005). Images in this sense are used as a way of telling other people, *this is*

the kind of car I drive and the kind of house I live in, akin to the tourist photography belief that you can't prove you have been somewhere or seen something unless you photograph it (Sontag, 1979, p. 87). This type of image content is often meticulously curated before it is finally uploaded online (Lin & Faste, 2012). Therefore the narrative that is being told can be continually altered and changed by the removal and addition of different images (Richter & Schadler, 2009).

Bringing together the elements of self-presentation and social signalling/attention, Cox, Clough, and Marlow (2008) carried out open-ended telephone interviews with 11 Flickr users in an attempt to 'explore the use of the system within the context of the interviewees' photographic practices.' One of the questions that was asked of participants was: 'Why do you use Flickr?' Overall, the interviewees expressed that they used Flickr as, 'part of a wider nexus of self presentation or communication through the web' and their collection of photos on Flickr was, 'usually a selection of the best or most appropriate to be shared.' Flickr itself was also found to be an important motivation for taking photos in the first place. Linked to self-presentation is the use of Flickr to host images that can then be linked to via other sites, for instance a personal blog (Van House et al., 2004). Users can create slideshows containing a selection of their Flickr images and this slideshow can then be embedded into another site such as a blog (Richter & Schadler, 2009).

As well as uploading images online so that feedback and comments can be received, Van House et al. (2005) claim that this perception of an 'online audience' encourages self-expression. Self-expression is about using photography to give a voice to one's view of the world and in expressing the things that are found to be humorous or aesthetically pleasing (Van House et al., 2004; Van House et al., 2005). Richter and Schadler (2009) define this as 'making statements about life'. Online photo sharing can be seen as a more conducive environment to this than traditional photo clubs due to the freedom that is created by the weak social ties in the Flickr community (Cox, Clough, & Marlow, 2008). It also allows for more specialised groups due to the scale of people that use the system.

Research by Prieur et al. (2008) has attempted to quantify the usage functionalities among all registered Flickr users (see Figure 2-1). This quantification shows that 62% of registered Flickr users either have inactive accounts, or are active but keep all of their images private, and thus out of the reach of investigation. The remaining 38% of users

have active accounts with public images uploaded. Although Prieur et al. (2008) define inactive accounts as those that both don't have any images uploaded and don't make use of any of Flickr's functionalities, the authors do not define exactly what aspects of functionality they are referring to, or indeed how functionality was measured. An article by Smith (2012) points to research carried out by a social media agency suggesting that 'active' Flickr accounts equate to 6.7 million users. However the author does not define whether this statistic concerning 'active' accounts includes only those accounts with public photos available or also active accounts with private images. For the 23% of Flickr accounts that are 'active' but contain no public images, it could be assumed that these users are utilising Flickr for online storage and backup of their images or for private personal reflection and memory. For the 38% of active users with public images uploaded, their reasons for doing so could still be for personal back up or reflection, as the default setting on Flickr accounts is to make images uploaded public and many people may not get around to changing this setting (Nov, Naaman, & Ye, 2009a). They could also have many other reasons for using Flickr too. If someone uses a site such as Flickr and keeps their images set to 'private' then it would seem safe to assume that they are using Flickr to back up their images or share them with a limited number of contacts. The family album is viewed as a private medium (Holland & Spence, 1991, p. 2) and therefore why would people want to make such images publicly available online? However, many images on Flickr are not of 'people' and 'family' therefore it could be said that Flickr is fulfilling more needs than just a presentation of the 'family album'.

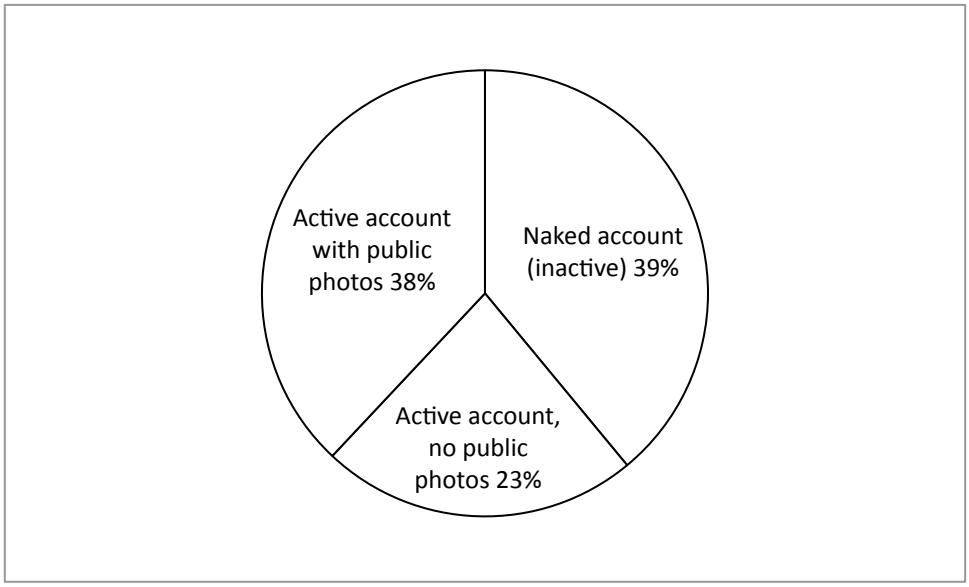


Figure 2-1 Usage functionalities among all registered Flickr users (based on Prieur et al., 2008)

The fact that online image management and sharing applications are being used for a range of different purposes, means that the boundaries between amateur and professional are becoming more blurred (Murray, 2008). It is therefore difficult to reduce motivation for using a service such as Flickr down to only one reason.

2.4 Tagging

Tagging is, 'a process by which users assign labels (in the form of keywords) to web objects' (Xu et al., 2006). Tagging can be approached from two main overarching perspectives (Trant, 2009): tags in the context of their function to organise, describe, and categorise resources; and the effectiveness of tags in aiding the retrieval of the resources they are attached to.

This thesis is concerned with how motivation to upload and tag images in Flickr affects the kinds of tags that are used, and although tags will be broadly discussed in terms of how useful they are, the term useful will be used within the context of a tag's relationship to the image it is attached to, rather than within the context of how useful the tag will be for the effective retrieval of images from Flickr. The following sections will therefore focus on tagging from the perspective of the Flickr users that carry out the tagging (the taggers), and the range of motivations that previous research has found for why users tag their images.

Tagging can be viewed as an activity that should to a large extent mirror the motivations for placing the item into the system in the first place. Figure 2-2 below (based on Smith, 2008, p. 12) shows how tagging sits at the intersection of three main areas: information architecture; social software; and personal information management (PIM).

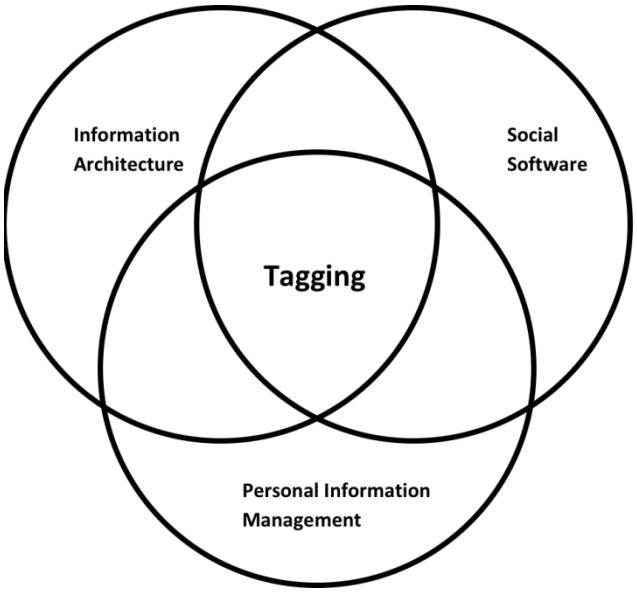


Figure 2-2 Visualisation of tagging

Information architecture is concerned with organising information so that others can find it and parallels can therefore be drawn with tagging's function of organising resources for future findability. Social software is the applications that people use to communicate, collaborate and share information via online, and tagging is often an integral part of social software as a mechanism for users to organise, share and find information. PIM (as discussed in section 2.3.1) relates to how people acquire, organise, maintain and use personal documents or resources, and tagging therefore refers to the organisational aspect of PIM (Smith, 2008, p. 13).

Heckner, Heilemann, and Wolff (2009) suggest that tagging is either for personal information management in the context of a solely personal collection of digital items organised for findability and later use, or for resource sharing, which does not imply any notion of personal refindability.

2.4.1 Categorising and indexing images

Tags are the keywords that are added to items by users (Smith, 2008, p. 5) as a way of organising, categorising, and describing content for future navigation or searching, and tags are fundamentally about sensemaking (Golder & Huberman, 2006; Trant, 2009).

Categorising items refers to 'the successive and hierarchical representation of information by categories' (Chu, 2010, p. 31). In analogue systems cataloguing is confounded by the problem of deciding what category to use (Lansdale, 1988). Whilst cataloguing systems allow a number of different keywords to be added to items and thus provide a number of retrieval points, items nonetheless have to be placed into one particular physical category, and this limits their ability to appear in a different category. This is an additional area where web 2.0 alleviates a traditional PIM problem. Analogue photos could obviously only exist in one place at a time. Sinha (2005) provides a rationalisation of how the approaches to these two practices differ from the perspective of the cognitive processes involved in each. Sinha (2005) explains that with categorisation, many people become worried that they will make the wrong choice as to which category an item should be assigned to, and Sinha coins the term 'post-activation analysis paralysis' to describe this. This is essentially the same problem that Lansdale described in 1988 in relation to PIM where people worry about placing items into the most appropriate category. A possible solution to this problem that Lansdale (1988) discussed was the design of systems that could allow for the use of multiple keywords. However, whilst tagging is often likened to categorisation, tagging is generally non-hierarchical (Golder & Huberman, 2006), and rather than tags being used to place an item into a category, tags are generally used to describe an item based on a number of attributes simultaneously. Thus tagging can be likened more closely to indexing. Indexing is the process of assigning terms or keywords to represent facets of a resource (Chu, 2010, p. 27). The use of tagging within PIM systems can therefore be seen as the solution that Lansdale envisaged. Tagging eliminates the necessity of having to choose 'just the right' category, and as many tags that the tagger deems as appropriate can be assigned to the item, rather than forcing users to only pick one, thus lowering the cognitive cost.

2.4.1.1 Traditional image indexing

In an investigation of the tags used for visual resources, it is useful to consider the work of image interpretation and theory, and image indexing, rather than focussing solely on the work of tag usage in relation to web 2.0 systems. Traditional image indexing has been achieved in a number of ways that generally involve assigning textual terms to the image in order to aid with its subsequent retrieval.

A library is a place that contains books, and although no two libraries are identical, many of the same books can be found in a different library of the same type (e.g., public, academic, special library). In comparison, the images in image collections are often unique, with no two places having the same collection. This has meant that unlike book classification, which has accepted standardised protocols for classification such as the Dewey Decimal System, there is no such equivalent standard that exists for the classification of images. As such there are a number of different approaches that have been developed and used.

One approach is similar to that of classification for text based material and that is to establish the bibliographic data that is associated with an image such as artist, photographer, title, and date. Graham (2001) describes this as formal description. Another approach focuses on the subject content of the image and is generally referred to as subject indexing (Graham, 2001). Subject indexing involves assigning terms to an image from a controlled vocabulary such as: a subject heading list (e.g., the Library of Congress Subject Headings); a thesaurus (e.g., Art and Architecture Thesaurus (AAT) or the Thesaurus for Graphic Materials (TGM)); or a classification scheme (e.g., ICONCLASS) (Graham, 2001). However, images have very different attributes to text (Baxter & Anderson, 1996) and as Rorvig (1990) points out, unlike a book, an image has no way of telling us what it's about. This leads to a very high level of subjectivity involved in image indexing, further exacerbated by the vast range of subject content, and as such there are problems with all of the approaches and systems. Thesaurus based systems such as the AAT are often criticised for using highly specialised and subject specific language, which is often far removed from the end users of a system. Whilst this was not as much of a problem in an analogue collection where a trained person would retrieve an image for a user, it is more of a problem with digital systems where the end users can often search a digital system themselves. Using a system such as the AAT is also a time consuming process often taking up to 40 minutes per image to assign the most appropriate terms (Eakins & Graham, 1999). As a consequence, many in-house classification schemes have been developed that focus more specifically on the kinds of images that are held in the collection. Corbis, the stock photography company, is one such company that has developed its own thesaurus. However, their system still has its problems. It takes a team of nine cataloguers and indexers working full time to categorise the images that come into their agency each day as they have to browse through their in-house list of 61,000 'preferred terms' to pick out the

ones that best describe the image in question, and they usually assign 10-30 terms per image (Weinberger, 2007, p. 20).

Berinstein (1996, p. 26) terms these differences in approaches as relating to the visual and non-visual attributes of an image. The non-visual relates to the biographical attributes (or formal description), and the visual, can relate to either the subject of the image (which is the hardest to describe), or to object aspects such as line, colour, composition, perspective, proportion, shadow and highlight, contrast, pattern and so on. This object aspect approach can be likened to content-based image retrieval (CBIR), which is concerned with the retrieval of images using automated systems that generally, 'annotate images based on pixel-level information' (Jansen, 2008, p. 82).

Work in the field of art history further complicates the process of image indexing by looking beyond the content of an image to also looking at its potential underlying meaning. The art historian Erwin Panofsky developed an approach to image interpretation that considers the 'three levels' of meaning in a work of art (Panofsky, 1962, 1983) and his work forms the basis of a lot of the subsequent theoretical work on image classification and indexing (Jörgensen, 2003). When looking at images, the primary (pre-iconographic) level of meaning is based on the recognition of objects within the image and factual information (e.g., chair, window); no subject specific knowledge is needed for this recognition. The secondary (iconographic) level involves an interpretation of the objects in the picture and as such requires more familiarity with the cultural context of the image (e.g., rocking chair, sash window). The third (iconological) level of description attempts to articulate the perceived intrinsic meaning of the content of the image, or what it is *about* (e.g., comfort, escapism).

Whilst Panofsky's work is aimed at being able to convey meaning in the fine arts, certain parallels can be drawn with the work of Rosch (1973) in the field of cognitive psychology. Rosch conducted a series of psychological experiments in the 1970s and proposed three levels of description that people use when they want to place objects into categories that are linguistically useful:

1. Superordinate description (e.g., an image of a dog, described as 'animal'. This can be likened to Panofsky's pre-iconographic level where no subject specific knowledge is needed to make the distinction).

2. Basic level description (e.g., an image of a dog, described as 'dog'. Similar to Panofsky's iconographic level, more subject specific knowledge is needed to make this distinction and a familiarity with the differences between different animals is needed to know it is a dog).
3. Subordinate description (e.g., an image of a dog, described as 'Labrador'). This third level deviates from Panofsky's third iconological level however, as whereas Rosch's subrordinate level relates to a specific type or category of the object in question, Panofsky's is more concerned with the intrinsic meaning of the image, and so at this level, Panofsky may describe the image as perhaps symbolising 'loyalty' since dogs are very loyal pets).

It is the basic level descriptors that have been found to be the most widely used (Lakoff, 1987, p. 49) as this is the level at which children tend to be taught and the level that has the highest cognitive visual representation (Rosch, 1978) i.e., it is easier to draw the features that are specific to a dog, than it is to draw either a generic animal, or the features specific to a Labrador.

Shatford (1986, 1994) rationalises that regardless of whether an image relates to the fine arts or the sciences, all images 'have attributes that can be categorised and generalised, based partly on the nature of images and partly on classification theory' (Shatford, 1986, 1994). These attributes can be designated to one of four general categories:

- Biographical attributes - who created the image, who it belongs to, the time and date it was created, where it has been, how much it costs.
- Subject attributes - images may be both *of* and *about* something. What an image is *of* is likely to be concrete and objective (pre-iconographic or iconographic). What an image is *about* is likely to be abstract and subjective (iconological). Images can also be both *generic* and *specific* at the same time; whilst an image may be specifically useful for its depiction of the Clifton Suspension Bridge in Bristol, UK, it may also be generically useful for its depiction of a bridge. The subject of the image can also be related to one of four facets: time, space, activities and events, and objects (either animate or inanimate).
- Exemplified attributes - an image may *be* an etching or a photograph, which is different to an image that is *of* an etching or a photograph.

- Relationship attributes - images can be related to or associated with other images or textual works, for example illustrations that accompany text, or an architectural drawing that accompanies the design of a building.

Shatford goes on to explain that some attributes are more important than others in certain circumstances, for instance it might be more important to assign an index term that denotes who created the image if it is perhaps an image taken by a well known photographer. This index term is likely to be of more value in this instance than perhaps even what the image is *of* or *about.* However there is no limit to the terms that can used to index an image, and so all attributes can be used if necessary.

Also taking an all-encompassing approach to image indexing, Jörgensen (2004) developed a hierarchical visual indexing thesaurus for the indexing of images across diverse subject domains using non-specialist terminology. The structure of her thesaurus contained eight main headings for image content: Image type/technique; Visual elements; Natural objects; Living beings; Produced objects; Man-made environments; Narrative elements; and Abstract concepts. These eight headings could be expanded to 48 top-level headings, and the top-level headings could be expanded to a further 782 second-level headings. However this approach to indexing – whilst inclusive of a wide range of domains – is nonetheless a prescriptive approach as terms can only be picked from the thesaurus and this does not therefore take into account the biographical attributes defined by Shatford.

In analogue collections of images, retrieval is a labour intensive process and knowledge of the structure of the whole collection is needed in order to know how to locate items. The switch from analogue to digital has assisted with this process in the sense that images are no longer restricted to one physical location and can ostensibly exist in more than one place at a time, and digital retrieval is also much quicker. However the problems with subjectivity and in determining the most appropriate way to index an image still remain. Graham (2001) summarises, ‘a picture can mean different things to different people, and it will also mean different things to the same people at different times.’

2.4.1.2 Domestic photography

Analogue photographs generally only exist in one place at a time due to their physical nature (although copies can be made), and as such they have traditionally been organised on the basis of spatial or temporal likeness such as dates and locations (e.g., 'holiday pictures 1995' or 'Daytrip to Stonehenge'). Photos were generally kept in display albums or paper wallets based on these two groupings, sometimes with notes written on the back of the photos explicitly indicating date, location, and perhaps a few extra notes and they would generally be organised and stored chronologically within the home (Frohlich et al., 2002). In an investigation into how people manage their collections of photographs, Rodden and Wood (2003) found that the organisation of traditional photos requires significant effort, and is not usually done to facilitate searching but to create an attractive 'presentation' of photos for keeping as part of a 'family' or 'personal' archive. At the turn of the twenty first century digital photography became mainstream and in 2004 digital camera sales overtook film cameras in the US (Clairmont, 2010). With digital cameras, people did not have to worry about running out of film and camera memory cards could hold a previously unimaginable number of images, people also believed the cost of digital images to be free (Kirk et al., 2006) and so people began to take many more images. This was fuelled by the fact that many digital cameras had LCD display screens allowing instant feedback on whether or not the image captured was 'just right'. Without the constraints of the physical photo album where an image could only exist in one place at any one time, photos could now digitally exist in a number of different locations and folders and could be organised based on a number of different facets. Whilst people are thought to be reluctant to annotate their digital images with text (Kirk et al., 2006), the freedom with digital nonetheless encouraged a more insouciant attitude towards organisation and was perceived to require much less effort and was more likely to be carried out with the intent of sharing the photos and allowing others to view them in the near future (Rodden & Wood, 2003). Images could also now be grouped according to more cognitive aspects such as what they meant to the photographer and what the content of the image was, rather than being limited to temporal and spatial affiliations such as date and location. Although in an investigation of the use of analogue and digital photos in 11 families, Frohlich (2002) discovered that very few of the families organised their digital photos on their PC, meaning that they had many 'miscellaneous' folders filled with sequences of numbered photos that had been uploaded in batches from their cameras to the PC. The burden of this task became exacerbated by the excess number of images that people were taking with digital cameras.

Participants in Van House et al.'s (2004) study were found to be reluctant to annotate cameraphone images as it takes time and effort. People also tend to prefer oral storytelling and such storytelling is tailored to the audience at that time. Annotating was also seen as admitting that 'we won't always be around to tell the story.'

2.4.2 How people tag

Terms that often go hand in hand with tagging are folksonomy, social tagging, and collaborative tagging (Matusiak, 2006; Trant, 2009). However there are quite subtle differences between the terms. Social and collaborative tagging is where many different users add tags to shared content (Golder & Huberman, 2006), whereas folksonomy (a portmanteau of the words 'folk' and 'taxonomy') coined by Thomas Vander Wal (Smith, 2004), is the aggregation of user generated tags that have emerged through bottom-up consensus (Quintarelli, 2005), forming a collective meaning among users (Trant, 2009).

A significant amount of research has been published on folksonomies (Mathes, 2004; Quintarelli, 2005; Vander Wal, 2005; Guy & Tonkin, 2006; Tonkin, 2006a; Trant & Wyman, 2006; Specia & Motta, 2007; Spiteri, 2007), and social/collaborative tagging (Golder & Huberman, 2006; Kipp & Campbell, 2006; Macgregor & McCulloch, 2006; Tonkin, 2006b; Aurnhammer, Hanappe, & Steels, 2006; Goh et al., 2009; Huang & Chuang, 2009; Shiri, 2009), and many people use the terms interchangeably. However this investigation will use the term tagging, as research that has specifically looked at Flickr has shown that people do not tend to tag other people's images in Flickr and only tag their own content (Marlow et al., 2006; Cox, 2008; Ding et al., 2009;), and folksonomies do not always emerge successfully when the people adding the tags don't know very much about the subject matter (e.g., other people's images) (Alexander, 2009). Therefore a lot of the work that looks at the practical applications of folksonomies and social/collaborative tagging is of limited value in this thesis. However Vander Wal (2005) defines two typologies of folksonomy: broad and narrow. Broad folksonomies are defined as those where many people tag the same item (as in the Delicious service where multiple users tag the same URLs). Narrow folksonomies (as in the Flickr system) are defined as those where users are more likely to be tagging content for their own retrieval purposes (i.e., their own collection of uploaded images). However, in the vast majority of web 2.0 sites, tags

assigned by individual users to resources are visible to the rest of the user community of the system regardless of whether or not they fall under the definition of a broad or narrow folksonomy; meaning that they both have the potential to persuade other users to use the same tags and foster consensus.

Previous research that specifically focuses on folksonomies and social/collaborative classification is however of value in relation to the fact that the strengths and weaknesses of tags in general tends to be discussed.

Weaknesses of tagging include: polysemous words (one that has many related senses) (Golder & Huberman, 2006; Spiteri, 2007); synonyms (words that have closely related meanings) (Mathes, 2004; Aurnhammer et al., 2006; Golder & Huberman, 2006; Guy & Tonkin, 2006; Spiteri, 2007); the use of plurals (Golder & Huberman, 2006; Guy & Tonkin, 2006); homographs (words that are spelt the same but have different meanings) (Macgregor & McCulloch, 2006); homonyms (words that have the same spelling and pronunciation but different meanings) (Aurnhammer et al., 2006; Guy & Tonkin, 2006; Macgregor & McCulloch, 2006); overly personalised tags (Guy & Tonkin, 2006; Macgregor & McCulloch, 2006); the same user can apply the same tag in different ways (Mathes, 2004); different tags are used for the same concept (Mathes, 2004); compound tags (Mathes, 2004; Guy & Tonkin, 2006); ambiguous tags (Guy & Tonkin, 2006; Spiteri, 2007); misspellings (Aurnhammer et al., 2006; Spiteri, 2007); use of abbreviations, initialisms and acronyms (Spiteri, 2007); use of neologisms, slang and jargon (Spiteri, 2007); use of nonsensical tags (Guy & Tonkin, 2006); accidentally adding the wrong tag (Aurnhammer et al., 2006); and that a person's tagging practice may vary over time and thus be inconsistent (Begelman, Keller, & Smadja, 2006). All of these weaknesses lead to criticisms that the high amount of 'noise' will impact negatively on retrieval precision (Macgregor & McCulloch, 2006) and it makes it impossible to know if a search request has retrieved all of the resources or items that are relevant to the search. Conversely however, it is said that all of these questionable attributes of tags are what enable a true representation of knowledge to be generated (Macgregor & McCulloch, 2006).

There are also many positive attributes of tags too: they provide an increased number of entry points (Macgregor & McCulloch, 2006); they allow for serendipitous searching (Mathes, 2004; Quintarelli, 2005; Macgregor & McCulloch, 2006); participation is far

easier in terms of time, effort and cognitive cost (Mathes, 2004; Quintarelli, 2005; Sinha, 2005; Tonkin, 2006b); they allow communication with other users (Mathes, 2004); they allow the discovery of long-tail topics (original and non-mainstream ideas/topics/concepts) (Quintarelli, 2005; Vander Wal, 2005); tags directly reflect the vocabulary of the users (Mathes, 2004; Quintarelli, 2005; Matusiak, 2006). Linked to vocabulary use, Argamon et al. (2003) studied the differences between males and females in a large set of formal documents and found that males tend to write in a more 'informational' manner, and females in a more 'involved' manner. Males also tend to write in a more literal way about objects, and women talk more about feelings and relationships between objects. Whilst this research was focussed on formal text, it may nonetheless transfer to the tag usage between males and females. Similarly, Argamon et al. (2007) found that age is also linked to writing style online. The use of words associated with family, religion, politics, and business increase with age, whereas the use of words such as fun, romance, music, and swearing decrease with age. The authors were able to effectively predict the age of bloggers by analysing their writing style. As this research was conducted on the use of text online, it seems likely that age may also influence the kinds of tags that users assign to resources online.

There have been many studies that have sought to analyse the similarities and differences of tagging in relation to traditional classification and indexing such as the Library of Congress Subject Headings (Thomas, Caudle, & Schmitz, 2009); Dublin Core metadata terms (Tonkin et al., 2007); tags in comparison to both author keywords for journal articles and controlled vocabulary subject headers such as INSPEC, Library Literature, and Pubmed (Kipp, 2006, 2007a, 2007c); the National Information Standards Organization (Spiteri, 2007); and WordNet corpora (Overell, Sigurbjörnsson, & van Zwol, 2009). The Library of Congress itself has recognised the potential of collaborative tagging in harnessing the collective knowledge of lots of people, and they have opened up 3,000 photos from two of their most popular collections for Flickr users to tag with the aim of being able to ensure better overall access to their collections and to obtain the richest information possible for the images in question (Raymond, 2008). Matusiak (2006) compared two sets of similar images (one set on Flickr, and the other set in the University of Wisconsin-Milwaukee Library). Matusiak (2006) found that the tags applied to the images in Flickr varied greatly in terms of depth, consistency, number of tags, and focus.

Some taggers of the set of images in Flickr focussed on aspects in the foreground of the image, while others focussed solely on assigning tags relating to items in the background.

There have also been investigations into the similarities and differences in the type of tags used in different services such as Delicious, Last.fm, Flickr, Connotea, Amazon, and CiteULike (Zollers, 2007; Bischoff et al., 2008). Bischoff et al. (2008) found that tags relating to topic, time, and location were the most popular kinds of tags across all web 2.0 services, whereas Zollers (2007) found tags in Amazon and Last.fm to be closely linked to the tagger's own personal feelings towards the resource.

There have also been many studies that have looked at the practical applications of tagging and folksonomy: using tagging to provide access to museum collections (Trant & Wyman, 2006); tag prediction models (Heymann, Ramage, & Garcia-Molina, 2008; Wang et al., 2010; Wetzker et al., 2010); tag clustering models (Begelman et al., 2006); assessing and improving the search retrieval effectiveness of tags (Aurnhammer et al., 2006; Morrison, 2008; Kipp & Campbell, 2010); recommendations for improving the quality of tags (Guy & Tonkin, 2006); comparing structured and unstructured tagging (Bar-Ilan et al., 2006); motivation to tag (Marlow et al., 2006; Ames & Naaman, 2007; Zollers, 2007; Thom-Santelli, Muller, & Millen, 2008; Nov, Naaman, & Ye, 2008); and looking at tag usage patterns (Golder & Huberman, 2006; Guy & Tonkin, 2006; Kipp & Campbell, 2006; Marlow et al., 2006).

One of the seminal papers in the area of tagging has been that of Golder and Huberman (2006). The authors analysed two sets of data in the Delicious service, one set containing 212 URLs and 19,422 bookmarks, and the second set containing 229 users and 68,668 bookmarks in order to discover patterns in the tagging practices of users. The authors identified seven functions of tags:

1. Tags to identify what (or who) the resource is about (i.e., the content)
2. Tags to identify what the resource is (i.e., article, blog, image etc.)
3. Tags to identify who owns the resource (i.e., who created the item)
4. Tags to refine existing categories (tags that can't stand alone and act to refine or supplement existing categories, such as numbers or letters).

5. Tags to identify qualities or characteristics (e.g., adjectives such as 'funny' or 'inspirational' – relates to the taggers opinion of the content of the item).
6. Tags relating to self-reference (e.g., MyStuff, MyWebsite – to identify how the item relates to the tagger).
7. Task-organising tags (e.g., ToRead, ToPrint – suggesting an action that needs to be performed in relation to the item).

Golder and Huberman (2006) found that as a user's tag lists grows over time, and the kinds of tags used often change, representing a new interest or category that the user is interested in. The authors defined categories 1 - 4 as tags that are 'extrinsic' to the tagger, and categories 5 - 7 as those that are 'relative to or only relevant to the tagger', and a conclusion from their investigation was that a significant amount of tagging is done for personal benefit. However, this is likely to be influenced by the fact that their investigation was on the Delicious service, where users are tagging items that they do not personally own (i.e., URLs), so they are therefore more likely to be using Delicious to gather and organise the resources of other people for their own use, rather than to primarily share them with other people. However, Golder and Huberman (2006) assert that the findings will apply to other tagging systems too. In an investigation of the Last.fm, Flickr, and Delicious services however, Bischoff et al. (2008) found that self-reference tags were not used very frequently.

Shirky (2005) also investigated the Delicious service and found great variability in the tagging strategies among the 64 users looked at, with some users assigning up to 600 unique tags per item, and others assigning only one or two. However, Paolillo and Penumarthy (2007) found that by focussing on a group of items rather than on a group of users, a selection of 4247 bookmarked videos on Delicious had been tagged in a fairly consistent way by a group of 2535 users, with a total of 2089 tags. The authors also indicated that the videos were of a range of different subject genres (e.g., music videos, animated shorts, political, Manga).

The authors Xu et al. (2006) suggest a similar range of tag types from their study of the My Web 2.0 website, although they use slightly different terminology:

1. Content tags (the same as tag function 1 on Golder and Huberman's list)
2. Context tags (describing location or time)

3. Attribute tags (the same as tag function 3 on Golder and Huberman's list)
4. Subjective tags (the same as tag function 6 on Golder and Huberman's list)
5. Organisational tags (the same as tag function 7 on Golder and Huberman's list)

In both instances the suggestions for the range of tag types include a mixture of biographical tags (similar to formal description), content tags (similar to subject indexing), and the addition of some new categories that are reflective of the web 2.0 dynamic (i.e., self-reference and organising tags). Xu et al. (2006) suggest that items are usually best described by a combination of different tags and Thom-Santelli, Muller and Millen (2008) assert that people try to remain consistent within their tag usage.

2.4.2.1 Tagging of images

Golbeck, Koepfler and Emmerling (2011) investigated how tagging behaviour relates to image content, and the authors used Panofsky and Shatford's combined image indexing scheme to classify the tags that had been assigned to a collection of 12 digital images of paintings from the Steve.museum dataset. The authors conducted a controlled lab experiment where 51 participants were shown the images for a period of 1 minute 45 seconds each, and were told to assign as many tags as they felt appropriate to each image. The authors found that the vast majority of tags fell into the general category, and that people are more likely to use tags that describe identifiable people and locations (iconographic tags). The authors also reported that abstract images received significantly more tags relating to visual elements than other kinds of images. Whilst the study is useful in providing evidence for the applicability of the Panofsky and Shatford image indexing protocol to a digital environment, the images utilised in the study were specifically art images and therefore the tag classification scheme they used did not need to take into account the web 2.0 environment of Flickr.

Rather than using a formal and controlled lab environment to get participants to tag images, von Ahn and Dabbish (2004) developed an interactive game called ESP, with the purpose that whilst people would be motivated to play the game due to their 'desire to be entertained', they would at the same time be creating meaningful labels for images on the web, allowing for more effective search and also improving the accessibility of sites. After a period of four months the game had been played by a total of 13,630 users, who looked at

293,760 images and generated a total of 1,271,451 tags. Taking a sample of 20 images, 85% of the total tags that had been assigned were deemed to be appropriate in relation to describing the image content. This is a very small sample however.

Research by Stvilia and Jörgensen (2010) looked at how people group photos into both individual photosets and groups in Flickr, and how the themes of such groupings were found to relate to different variables such as: activity, place, thing, person, artistic/photographic technique, random, time, and quality. Most individual photosets (40.4%) from their sample of 13,212 were found to relate to activity. In contrast, most groups (29.9%) from their sample of 11,140 were organised more around things (such as motorcycles, cars, clothes, etc.). In a user generated image database, such as Flickr, user generated classification (or folksonomy) of images in the form of tags is the principal method of retrieving images. Although Lerman and Jones (2006) argue that social browsing through 'contacts' photo streams is one of the primary methods by which users find new images on Flickr', this relies on users of Flickr being active uploaders and having designated 'friends' in the system who are likely to have appropriate images uploaded. It seems more likely, in reality, that searching for specific image content by tags will produce higher levels of precision, thus reducing the time cost to the searcher, an important factor in a database that holds more than 3 billion images (Flickr, 2009). Ames and Naaman (2007), in a study looking at users' motivations for tagging images in Flickr and Zonetag, found that people were primarily motivated to tag for organization for others (photo pools, and search), and self-organization (adding tags for personal later retrieval) and social-communication (adding tags as a way of signalling to other users) came joint second.

Dotan and Zaphiris (2010) found that Flickr users from Iran and Peru are more likely to include their country name and capital city as a tag, suggesting potential strong nationalism. Whilst people from Iran and Israel were found to tag in English, users from Peru tend to tag in Spanish, and users from Taiwan tend to tag in Taiwanese, although this is indicative of the fact that Spanish and Taiwanese are more widely spoken languages than Persian and Hebrew. The authors also found that users from Taiwan, Iran and Israel tagged in English unless photos were perceived as having a strong cultural context that was difficult to translate to English.

Ding et al. (2009) in an analysis of tagged images in Flickr, found that non-professional photographers tend to tag so that others can retrieve images and professional photographers do not tend to make use of tagging. However the authors don't indicate how they identified users as being either professional or non-professional. It was also found that tags relating to colour, and the current year were the most popular types of tags. Other key issues that have been reported with regards to Flickr tags is the fact that they don't always describe the content of the image, and are thus more closely linked to the motivation of the image uploaders (Kennedy et al., 2007). Conversely, it is also often claimed that Flickr users don't bother tagging their images at all as it is often found to be a boring and difficult task (Heckner, Neubauer, & Wolff, 2008; Cox, Clough, & Marlow, 2008; Heckner, Heilemann, & Wolff, 2009; Stvilia, 2009).

There have been many additional studies that have specifically looked at tagging and aspects related to Flickr. These have included: how Flickr can be used by libraries (Gordon & Stephens, 2006; Stephens, 2006); the use of Flickr for academic image collections (McWilliams, 2008; Angus, Stuart, & Thelwall, 2010); how people search, browse, interact, and find images on Flickr (Lerman & Jones, 2006; van Zwol, 2007; Mislove et al., 2008; Prieur et al., 2008;); Flickr groups (Negoescu & Gatica-Perez, 2008; Negoescu et al., 2009; Cox, Clough, & Siersdorfer, 2010); comparing Flickr tags to image index terms, (Rafferty & Hidderley, 2007; Chung & Yoon, 2009; Rorissa, 2010), the Thesaurus for Graphic Materials (TGM) and the Library of Congress Subject Headings (LCSH) (Stvilia & Jörgensen, 2010); tag recommendation strategies (Lerman, Plangprasopchok, & Wong et al., 2007; Sigurbjörnsson & van Zwol, 2008); using Flickr geo-tags to improve access to multimedia resources (Kennedy et al., 2007); Flickr's place in the world of photography (Cox, 2008; Cox, Clough, & Marlow, 2008; Murray, 2008; Richter & Schadler, 2009); cultural differences in content (Dotan & Zaphiris, 2010; Pengiran-Kahar et al., 2010); why people use Flickr (Van House, 2007; Liu et al., 2008; Nov, Naaman, & Ye, 2009a, 2009b; Stvilia & Jörgensen, 2010); and motivation to tag images in Flickr (Marlow et al., 2006; Ames & Naaman, 2007; Nov, Naaman, & Ye, 2008; Heckner, Heilemann, & Wolff, 2009; Angus & Thelwall, 2010). This large list reiterates the interest and potential of Flickr for scholarly research.

2.4.3 Motivation to tag

As Hasan et al. (1998) points out, an activity (e.g., tagging) can be carried out as a result of a number of different behaviours (i.e., motivations). As mentioned previously, both the purpose of a system and a user's motivation(s) for using the system is said to be responsible for how people tag (Heckner, Heilmann, & Wolff, 2009; Hammond et al., 2005; Marlow et al., 2006), but a user's motivation for tagging may differ from their motivation to use the system, and so it is important to also look at motivation for tagging.

Hammond et al. (2005) claim that because Flickr users are likely to be managing personal collections of their own photos, they are more likely to adopt a selfish tagging discipline. In contrast, Marlow et al. (2006) and Miller and Edwards (2007) claim that users in Flickr are primarily motivated by social incentives to tag and for the benefit of others. Similarly, Van House (2007), and Cox, Clough, and Marlow (2008) in their investigations of Flickr users found that most people viewed tags as being for the benefit of other people and to increase the amount of people who could find and view their photos.

More recent literature acknowledges that Flickr fulfils a range of different needs (Dotan & Zaphiris, 2010) and therefore a mixture of these different needs tends to drive tagging (Heckner, Heilemann, & Wolff, 2009). Users can often have one or two primary motivations for tagging (Ames & Naaman, 2007).

Motivations for tagging were discussed by Hammond et al. (2005), in their review article on emerging social bookmarking tools. They asserted that there are two main reasons for tagging: selfish and altruistic. A 'selfish' tagging discipline is where users are tagging content for their own retrieval. An 'altruistic' tagging discipline is where the user is tagging content so that other people can find it. Subsequent work has used different terminology to distinguish between the two main tagging motivations: Marlow et al. (2006) used the terms organisational vs. social; Heckner, Heilemann and Wolff (2009) used the terms personal information management vs. resource sharing. However these distinctions are still based around the practices of either tagging for one's own organisation and retrieval purposes, or so that other people can easily find the resources that have been tagged, although they don't use emotive language such as 'selfish', which implies that users are expected to tag in a selfish way. Smith (2008, p. 15) states there is a constant tension in tagging systems between whether or not people tag resources for their own

benefit, or by the desire to share information with other people for a range of social reasons.

In a series of papers by Körner et al. (2010), Strohmaier, Körner, and Kern (2010), Kern, Körner, and Strohmaier (2010), and Zubiaga, Körner, and Strohmaier (2011), motivation to tag is defined as being to either describe (i.e., to construct and maintain a navigational aid to the resources) or to categorise (i.e., to capture a rich variety of possible interpretations of a resource) and the authors use a set of statistical measures of tags to provide an approximation of tagging motivation. The statistical measures that Körner et al. (2010), Kern, Körner, and Strohmaier (2010), and Strohmaier, Körner, and Kern (2010) develop to assess tagging motivation in Flickr are tag/resource ratio, orphaned tag ratio, conditional tag entropy, overlap factor, and tag/title intersection ratio. The authors found that 'categorizers' tend to use identical tags across a range of images, whereas a 'describer' will typically have a lot of infrequently used tags and lots of synonyms (Körner et al., 2010). However overall, most taggers seem to use a mixture of tags for both categorization and description (Kern, Körner, & Strohmaier, 2010; Körner et al., 2010).

The work of Marlow et al. (2006) was the first to begin expanding the two tagging disciplines, and they proposed subcategories of motivations that were added under their headings of organisational and social. The authors posited that organisational tagging arises from the use of tagging 'as an alternative to structured filing' (Marlow et al., 2006) and the subcategory of 'future retrieval' was added. The authors asserted that social tagging expresses 'the communicative nature of tagging, wherein users attempt to express themselves, their opinions, and specific qualities of the resource through the tags they choose' (Marlow et al., 2006). A number of additional subcategories were added to Marlow et al.'s (2006) social category: contribution and sharing (to add to conceptual clusters for the value of either known or unknown audiences); attract attention (tag in order to get people to look at one's own resources); play and competition (to produce tags based on an internal or external set of rules); self-presentation (to write a user's own identity into the system as a way of leaving their mark on a particular resource); and opinion expression (to convey value judgements that they wish to share with others).

Zollers (2007) states that if users of a system are motivated by personal reasons, but are aware of an audience for their tags, then tagging is no longer a self-serving activity, as it

becomes a social act. Nov, Naaman and Ye (2008) support this claim, explaining that behaviour is affected by presence (actual, imagined, or implied). However, their reasoning is based on positive correlations between social tagging motivations and number of tags used, rather than any analysis of the kinds of tags that are linked to social tagging motivation. Similar to Marlow et al. (2006), Zollers (2007) proposed three emerging social motivations for tagging images: opinion expression (e.g., scary, funny, inspirational); performance (tags intended to influence other users of the system, such as 'crime against humanity', or 'waste of time and money'); and activism (tagging to reconfigure normality and reality such as, 'defective by design'). Zollers's (2007) investigation was carried out on the Last.fm and Amazon sites, and it therefore seems more likely that tags relating to performance and activism are perhaps more suited to these two systems than any others (e.g., trying to influence other users not to buy certain products or to express a love of a particular kind of music). However, it can't be ruled out that these kinds of tags might not also appear in a system such as Flickr, where people might post images from a gig they enjoyed, or from a protest march, especially in light of the tendency for cameraphones to be used in new and novel situations. Although Meyer (2008) asserts that people are not always as interested in tagging cameraphone images.

Heckner, Heilemann, and Wolff (2009) compared motivation for using Flickr with perceptions of tagging in order to find out if users were motivated by personal information management (PIM) or resource sharing. Whilst the authors found that PIM and resource sharing were both major motivations for using Flickr, perception of tagging could not be strongly mapped to either motivation as they found that Flickr users tended to avoid tagging. However only 48 participants were included in their investigation, and no indication is given as to the survey question wording relating to perceptions of tagging. It could have been that participants were asked if they enjoyed tagging, and whilst people may tag resources for a variety of reasons, it does not necessarily mean that they enjoy doing so, and hence a closed question of this nature would result in respondents answering no, and thus giving the impression that tagging is not widely utilised.

Thom-Santelli, Muller and Millen (2008) discuss motivation in terms of users having 'tagging roles', drawing from literature that explains how social roles emerge in online communities. The authors utilised a blogging tool, a contact directory, a social bookmarking website and a podcast repository to look at how 33 individuals tagged

resources and they proposed five major social tagging roles: community-seeker (using tags to articulate social connections to others); community-builder (tailoring tags so that intended recipients can find resources more easily); evangelist (tagging to draw attention to his or her resources and content and enhance reputation); publisher (tagging to increase traffic from a largely undifferentiated target group); and team leader (employing tags as a signalling device by using terminology that will be understood by in-group members).

In a range of in-depth semi-structured interviews with 13 Flickr users, Ames and Naaman (2007) found that interviewees generally had one or two main motivations for tagging, and that participants also state they consider multiple audiences (themselves, friends and family, and the wider Flickr community). Realising that motivation to tag did not necessarily fit into one exclusive category, the authors developed a taxonomy of tagging motivations taking into account both the underlying purpose of the tag and its intended audience, and they placed these motivations along the dimensions of sociality and function (see Table 2-1). The sociality dimension refers to the intended audience for the tag (i.e., for oneself, or for others: friends/family/public). The function dimension relates to the intended purpose of the tag (i.e., is it to aid with organisation: storing the image for future retrieval or posting it to a group. Or, is it to aid with communication: providing context about the image content, or perhaps tagging it as a way of drawing attention to it from other Flickr users). Along each dimension, there is the possibility of two main motivations, and whilst the authors list a number of subcategories, it is posited that all motivations fit under one of the four overarching motivations of: social-organisation, social-communication, self-organisation, and self-communication.

Ames and Naaman (2007) assert that the main purpose of the social-organisation tagging motivation is to make the image findable by other users and they include the subheadings: contribution attention and ad hoc photo pooling. The authors liken these subheadings to Kindberg et al.'s (2005a) *social functional* intentions for image capture, where images are taken with the intent to share with other people who were present at the time of capture in order to support a specific task (e.g., taking photographs at a workshop or conference to share with those who were present), and images intended to support a task with people remotely (e.g., photographing a particular hairstyle to show to a hairdresser at a later date). Ames and Naaman (2007) rationalise that tags assigned to images in this context supports the motivation of social-organisation.

Table 2-1 A taxonomy of tagging motivations (based on Ames & Naaman, 2007)

		Function	
		Organisation	Communication
Sociality	Self	• Retrieval, directory • Search	• Context for self • Memory
	Social	• Contribution, attention • Ad hoc photo pooling	• Content descriptors • Social signalling

Ames and Naaman (2007) describe the purpose of the social-communication tagging motivation as being to communicate contextual information to others about the image, and consequently themselves. The authors include the subheadings: content descriptors and social signalling. These subheadings are likened to Van House et al.'s (2004) and Marlow et al.'s (2006) self-presentation and self-expression motivations behind image capture. Smith (2008, p. 29) asserts that tags can be used to express oneself and to inform other users in the system something about their personality and the kinds of things they like or dislike. Linked to self-presentation, Walker (2005) highlights that 'Flickr has twice as many photos tagged "me" as photos tagged "baby", and people take a lot of photos of babies.'

The authors describe the purpose of the self-organisation tagging motivation as being representative of the traditional perception of tagging, in that it is to aid with storage, description, categorisation, and future retrieval for oneself. This motivation aligns with using Flickr as a place to securely store images, away from the perceived vulnerability of desktop computers and external hard drives.

For the self-communication tagging motivation the authors include the subheadings: context for self and memory. The purpose of this motivation is to tag in order to add context to images that will help to facilitate remembering details in the future. In their study of Flickr users, Ames and Naaman (2007) found that most participants were motivated to tag by social-organisation, with self-organisation and social-communication tied for second. Whilst many of the motivations Ames and Naaman (2007) discuss have been covered to some extent by a combination of the previous work of tagging motivation,

Ames and Naaman (2007) provide the most comprehensive overview of all of the motivations, and all of the other motivations discussed can be slotted into the overarching motivation categories proposed by Ames and Naaman (see Table 2-2).

Table 2-2 Summary of motivations for tagging

		Function	
		Organisation	**Communication**
Sociality	**Self**	- Selfish (Hammond et al., 2005)	- Context for self - Memory (Ames & Naaman, 2007)
		- Personal information management (Heckner, Heilemann & Wolff, 2009)	
		- Categorizer (Körner et al., 2010; Strohmaier et al., 2010; Kern et al., 2010; Zubiaga et al., 2011)	
		- Future retrieval (Marlow et al., 2006)	
		- Retrieval directory - Search (Ames & Naaman, 2007)	
	Social	- Altruistic (Hammond et al., 2005)	- Attract attention - Play and competition - Self-presentation - Self-expression - Opinion expression (Van House et al., 2004; Marlow et al., 2006)
		- Contribution (Marlow et al., 2006)	
		- Resource sharing (Heckner, Heilemann & Wolff, 2009)	- Opinion expression - Performance - Activism (Zollers, 2007)
		- Describer (Körner et al., 2010; Strohmaier et al., 2010; Kern et al., 2010; Zubiaga et al., 2011)	- Content descriptors - Social signalling (Ames & Naaman, 2007)
		- Team leader (Thom-Santelli et al., 2008)	- Community seeker - Community builder - Evangelist - Publisher (Thom-Santelli et al., 2008)
		- Contribution attention - Ad hoc photo pooling (Ames & Naaman, 2007)	

2.5 Summary

The main aim of this thesis is to compare users' motivations to upload and tag their images in Flickr with how they tag their images in practice. This chapter has reviewed literature relevant to this aim, framing the research studies investigated within the contexts of motivation and tagging. The chapter was structured in three main sections: the motivations behind capturing images; what motivates people to upload their images to Flickr; and tagging (covering both its likeness to traditional image indexing, and also what motivates Flickr users to tag their images).

The chapter has illustrated that there are many different reasons behind why people capture images and photographs, and that these reasons are likely to influence people's motivations

for subsequently uploading images online to sites such as Flickr. Tagging is a key aspect of Flickr and many web 2.0 sites, and it is generally intended to aid with the organisation, categorisation, and description of resources. There is a significant body of literature that has looked at the similarities and differences between tagging and traditional indexing, and also many studies that have investigated how people tag in web 2.0 services. A number of studies have attempted to correlate motivation with tagging, but have done so from the perspectives of statistical or linguistic features of tagging (e.g., tag length, tag entropy, word class), or have attempted to define motivation solely on the basis of a user's interaction with Flickr (e.g., number of contacts, group membership etc.). A limited number of studies have correlated motivation and tagging via the use of survey methodology where users have been directly asked about their motivations. However, no research has attempted to correlate motivation and tagging whilst also taking into account the highly subjective nature of image tagging in Flickr. Images in Flickr are generally highly personal, and successfully interpreting types of tags relies on viewing images in conjunction with tags. Many studies have investigated tags without ever looking at the images the tags are attached to, and many studies have tried to determine motivation without ever asking users what actually motivates them. It is this gap in the existing body of literature that this thesis investigation will fill.

3 Preliminary studies

This chapter documents two preliminary studies that were designed to test the suitability of Flickr for investigations into web 2.0 images and tagging. The studies were designed to focus on tagging rather than aspects relating to the motivation for uploading and tagging in Flickr. There were two main purposes of these studies: firstly, to test the suitability of the Flickr API for extracting image and tag data; and secondly, to develop a suitable tag classification scheme that could be used in the principal investigation. Preliminary studies play a central role in information science and web based investigations as they enable an iterative process of determining the most effective methodology for the final investigation and also in determining the worth of such an investigation.

1. The first study, *General patterns of tag usage among university groups in Flickr* (Angus, Thelwall, & Stuart, 2008), looks at patterns of tag usage in order to develop a classification scheme for determining what functions tags generally perform in Flickr. This was important, as no previous research had proposed a tag classification scheme for web 2.0 images that combined image interpretation theory with elements specific to the analysis of web 2.0 tags. The main purpose of the development of this classification scheme was to assist with research aim no. 3 - identifying how users tag their images in Flickr.

2. The second study, *Flickr's potential as an academic image resource: an exploratory study* (Angus, Stuart, & Thelwall, 2010), looks at the visual typologies of Flickr images to give an indication of the use of Flickr beyond the context of amateur photography and to investigate the value of Flickr as an academic image resource. This study also plays an exploratory role in testing the content analysis methodology of Krippendorff (2004), that will be used to develop a subsequent protocol in order to more fully investigate motivation in both the pilot study and principal investigation.

3.1 General patterns of tag usage among university groups in Flickr

This study investigates the online image management and sharing application, Flickr; it explores to what extent looking at tags and images in isolation can be used to reveal the intention behind using Flickr.

Mathes (2004) hypothesised that tag usage in web 2.0 systems would follow a power law, whereby the most used tags are more likely to be re-used since they are more likely to be seen. Guy and Tonkin (2006) tested this hypothesis on tag usage in the Flickr (narrow folksonomy) and Delicious (broad folksonomy) services and found that tag usage followed a power law distribution in both instances.

Golder and Huberman's (2006) notions of tags being extrinsic to the tagger or relative only to the tagger seem broadly similar to the Marlow et al. (2006) premise that motivations to tag can be categorised into two main practices: organisational and social. Organisational practices arise from the use of tagging as an alternative to structured electronic filing (i.e., filing items by date, type etc. for personal future retrieval). Social practices express the communicative nature of tagging, where people tag so that other users of the system are able to view and find their content. Similarly, Hammond et al. (2005) define these user motivations as 'selfish' or 'altruistic'. Hammond et al. (2005) argue that the nature of a web application is responsible for driving a particular tagging practice for its users. They claim that because Flickr users are likely to be managing personal collections of their own photos, they are far more likely to adopt a 'selfish' tagging discipline. In contrast, Marlow et al. (2006), Van House (2007), Miller and Edwards (2007), and Cox, Clough, and Marlow (2008) state that users in Flickr are primarily motivated by social incentives to tag.

3.1.1 Research questions

Whether Flickr image tags tend to be for personal organisation or for the benefit of wider users is likely to be dependent upon the context in which the images are placed. With such a broad range of users utilising Flickr, this preliminary study focuses upon one particular category of image group: universities. This category was chosen, as the subject is familiar to the researcher. Although it is not clear how much of the participation in university groups is on a formal level (e.g., university marketing departments) or on an informal level

(e.g., individual students), these groups have the potential to be of value to universities, providing an instant visual entry point into the world of university life, and could therefore be used as a valuable marketing tool for attracting potential students and collaborating institutions. However, such practices would require the images to be tagged in a useful manner. Using automatic data collection, classification, and informetric analysis this study investigates the tagging practices in university groups and addresses the following question: *Are the images in university groups tagged in a manner that is useful for people other than the person who uploaded the image?*

More specifically, this study aims to answer the following sub-questions relating to tag usage patterns:

- What function do tags generally perform in Flickr?
- Do image tags tend to follow a power law distribution?
- How exhaustive are Flickr users in assigning tags to the images they upload?

3.1.2 Methods

Based on the research questions identified, the investigation was carried out in three main parts: data collection; a classification of image tags (in order to determine the general function of the sample of tags); and finally, an analysis of the general patterns of tag usage using informetric techniques (specifically looking at the number of tags used per image and comparing tag frequency to a Zipfian distribution).

Data Collection (November 2006)

Utilising Flickr's Application Programming Interface (API), a program was written which retrieved a list of all of the groups within Flickr that had the term 'university' as part of their group name or description (e.g., University of Wolverhampton). A total of 2,374 groups were identified, of which 1,983 had publicly accessible images. Ten of the most recently uploaded images from each of the university groups were retrieved, giving a set that was not biased in favour of the groups with larger image collections. Where this was not possible, due to there not being ten publicly available images, as many as possible were retrieved, resulting in a collection of 15,353 images, of which 12,812 had tags assigned. The 12,812 images that had tags were then assigned with a random number, and from this, a sample of 250 random images were taken, along with all of their accompanying tags.

Classification

All of the 250 images were looked at alongside their tags, and tags were classified according to the perceived relationship with their accompanying image. Tags could not be looked at in isolation due to the complex nature of image interpretation. Golder and Huberman (2006) point out the problem with polysemous words and tags. Polysemous words have many related senses. For example, 'a 'window' may refer to a hole in the wall or to the pane of glass that resides within it' (Golder & Huberman, 2006). Homonyms would also cause a problem if tags were looked at in isolation (i.e., the tag 'bat' could mean the small nocturnal mammal or a wooden implement with a handle). Without looking at a tag's accompanying image it would be impossible to distinguish the true meaning of some tags.

Drawing on the work of Panofsky (1962, 1983), Shatford (1986, 1994), and Golder and Huberman (2006), and also by visiting a random selection of tags and images, a classification scheme was developed that comprised of possible categories for all image tags in Flickr (see Table 3-1). Using the three levels of meaning in a work of art as defined by Panofsky (1962, 1983), and the notions of 'of' and 'about' as defined by Shatford (1986, 1994), categories A1, B1a, B1b and B2 were developed. Drawing on the work of Golder and Huberman (2006), categories C1, C2, C3, and C4 were added. Categories C5, D1, D2 and D3 were created as a result of visiting a random selection of images and tags within the Flickr site.

Mirroring the work of Golder and Huberman (2006), the classification scheme used in this study can be split into tags which seem to be useful for the community of the system as a whole (or extrinsic tags as defined by Golder and Huberman), and tags which seem to be beneficial to only the tagger themselves (or intrinsic tags as defined by Golder and Huberman) (see Table 3-2, column 2 of the results section). This split, however, differs quite considerably from Golder and Huberman's distinctions. Whilst they define the tag category of 'identifying who owns' the resource as being extrinsic to the tagger, it seems likely that unless users of Flickr are specifically searching for images uploaded by people that they know, then a tag that denotes ownership is likely to be of little value.

Table 3-1 Tag classification scheme

A		**Generic relationship between tag and image content**
	1	Tag identifies what image is **of** at its most primary and objective level - no subject specific knowledge is needed to make this distinction (e.g., an image of a cat, tagged as 'cat' or 'animal').
B		**Specific relationship between tag and image content**
	1(a) 1(b)	Tag identifies what image is **of**. Familiarity or some existing knowledge is needed to make this connection, and to a certain extent an assumption has to be made about this connection. Tags that identify place names/events – an image of the Eiffel Tower in Paris tagged as 'Eiffel Tower' requires knowledge acquired from familiarity with the specific place in question. Assumptions have to be made that an image tag is what it claims to be if the image is not familiar. Tags that identify people/animals – an image of Elvis Presley tagged as 'Elvis Presley' requires knowledge and familiarity of Elvis Presley. Distinctions cannot always be made between 'famous' people and 'non-famous' people, therefore the assumption has to be made that an image of a girl, tagged as 'Sarah' is in-fact an image of a girl who is called 'Sarah'.
	2	Tag identifies what the image is **about** Typically expressed by the use of abstract nouns or adjectives - an interpretation is made of what the image is about (e.g., image of people smiling tagged as 'happiness'; image of cars on a motorway tagged as 'speed').
C		**Tag only useful to individual/university group**
	1	Refining tag Tag that cannot stand alone - only useful when looked at as part of the larger tag set (e.g., a series of collective images, each with a specific number or letter; acronyms; dates; or information about the camera model which the image was taken with).
	2	Self-reference tag Tags that identify image content in terms of its relation to either the tagger or the specific group that the image belongs to (e.g., 'my dog'; 'our graduation') OR tags which appear useful, but show no relationship/connection to the accompanying image.
	3	Task-organising tag Tags that indicate an action required on behalf of the tagger (e.g., 'move to folder…'; 'print').
	4	Tag that explicitly denotes ownership of image (e.g., image tagged with the same username as that of the person who uploaded the image).
	5	Compound tag Tags where words, phrases and sentences are joined together as one long text string.
D		**Miscellaneous categories**
	1	Misspelling (e.g., 'Belguim' instead of 'Belgium') Whilst it may be obvious what the tag is meant to be, a misspelling obviously renders the tag useless in terms of subsequent users of the system who are searching for images with that specific tag, unless they too misspell the tag/word.
	2	Unable to determine relationship Despite having attempted to look up either the meaning of the tag and whether the tag is a foreign word or not, tags which do not fit into any of the above categories will be deemed as unable to classify (e.g., nonsensical words).
	3	Foreign word/character

Conversely, Golder and Huberman define the tag category of 'identifying qualities or characteristics' as being relevant only to the tagger. This tag category is essentially an iconographic level of interpretation, and is therefore useful to other users who are interested in images based on the same level of interpretation.

Category D3 (foreign words/characters) was not included in this split. The analysis was carried out from the perspective of an English speaker; therefore distinctions could not always be made regarding which category a foreign word/character should be assigned to.

Informetric Analysis

An informetric analysis was carried out into the frequency of tags used and the number of tags used per image for all of the images retrieved (i.e., up to ten per university group). The frequency of tags used gives an indication of the range of language (tags) used and whether this corpus is following a traditional language distribution (Boyce, Meadow, & Kraft, 1994). It also allows further checking of Mathes's (2004) hypothesis that tag usage will follow a power law distribution. Analysis of the number of tags used per image gives an indication of the effort put into the tagging process by image uploaders.

3.1.3 Results

The final classification sample of 250 random images (from the 12,812 images that had tags assigned) had a total of 2,006 accompanying tags. Table 3-2 shows the total amount of tags that fell into each of the classification categories, as well as the percentage of overall tags that were apparently useful to the Flickr community as a whole, and those that would only be useful to the individual/group.

The results show that over half of all the tags that were classified (excluding foreign words/characters) fell into categories that seem to be useful for the user community of the system as a whole. The highest proportion of tags fell into the B2 category – tags which identify what the image is about (e.g., adjectives and descriptive terms). As Table 3-2, column 4 shows, 12% of all tags classified were compound tags (i.e., words/phrases/sentences joined together as one long text string). Whilst in the vast majority of cases it was obvious what the separated words would be, they are still confusing to decipher when first looked at and it is unlikely that users would search for images using compound terms; therefore compound tags were classified as not being useful to the Flickr community as a whole. Also, Flickr does allow for spacing between terms in tag names, although it could be that image uploaders mistakenly believe that spacing is not allowed in Flickr tags, as is the case with other web 2.0 services such as Delicious. However whilst Flickr discards spaces for the purposes of retrieval and

combines phrases into compound terms, the tag classification in this investigation is not assessing effective retrieval, merely the relationship between the image and its tag(s), and the usefulness of the tag(s) as descriptors.

Table 3-2 Frequency and percentage of tag categories for 2,006 tags from random Flickr university image groups

Classification Category		Tag Motivation	Overall Percentage of Tags	Frequency & Percentage	
A1	Tag generically identifies what image is 'of'	**Useful to Flickr community as a whole** Social (Marlow et al., 2006) Altruistic (Hammond et al., 2005)	52%	309	15%
B1a	Tag specifically identifies what image is 'of' (place names/events)			289	14%
B1b	Tag specifically identifies what image is 'of' (people/animals)			43	2%
B2	Tag identifies what image is 'about'			398	21%
C1	Refining tag	**Useful only to individual/group** Organisational (Marlow et al., 2006) Selfish (Hammond et al., 2005)	39%	262	13%
C2	Self-reference tag			244	12%
C3	Task-organising tag			0	0%
C4	Tag which denotes ownership			31	2%
C5	Compound tag			233	12%
D1	Misspelling			5	0%
D2	Unable to determine relationship			5	0%
D3	Foreign word/character		9%	187	9%

Number of Tags Used

From the initial sample of 15,353 images, 16% had no tags. For the 12,812 images that did have tags assigned to them, the mode average for the number of tags used was four, with 9% of all of the images looked at in the analysis having four tags assigned to them. A total of 53% of the images had more than four tags, which suggests that uploaders put considerable effort into tagging their images; this should hopefully aid with subsequent image retrieval. It should also be noted that images that had a high number of tags assigned came from a variety of different university groups, indicating that no one particular university was overly dominant or exhaustive with their tagging. Overall, in browsing through the images two particular genres of image tended to dominate the university groups: photographs of an architectural nature (e.g., university buildings) and photographs of groups of people (e.g., graduation images or groups of friends posing for the camera), and these two genres tended to attract an equal amount of tagging from users.

Frequency of Terms Used

A further analysis was carried out which looked at the tag frequency for the 15,353 images (i.e., up to ten for each of the groups with publicly accessible images). There were 114,678 tags used in total, with 26,599 unique tags.

With a logarithmic transformation applied to the axes, Figure 3-1 shows that the terms used within the Flickr university groups loosely follow a Zipfian power law distribution whereby the frequency of any given term is inversely proportional to its popularity rank (Wolfram, 2003). The results indicate that single use tags do not dominate the Flickr system; instead, natural agreement regarding term usage tends to emerge through a bottom-up consensus (Wright, 2004) where many users agree on using a few popular tags. This supports Mathes's (2004) and Guy and Tonkin's (2006) research into tag popularity and distribution. However, the slightly skewed nature of the distribution can perhaps be attributed to the fact that the tags looked at were from a biased sample (i.e., university image groups) with the top tag, 'university' accounting for 0.95% of all tags used, along with '2006' (0.8%), and with 'Architecture' (0.4%), 'College' (0.37%), and 'Campus' (0.35%) being the highest-ranked tags in the 'normal' part of the distribution.

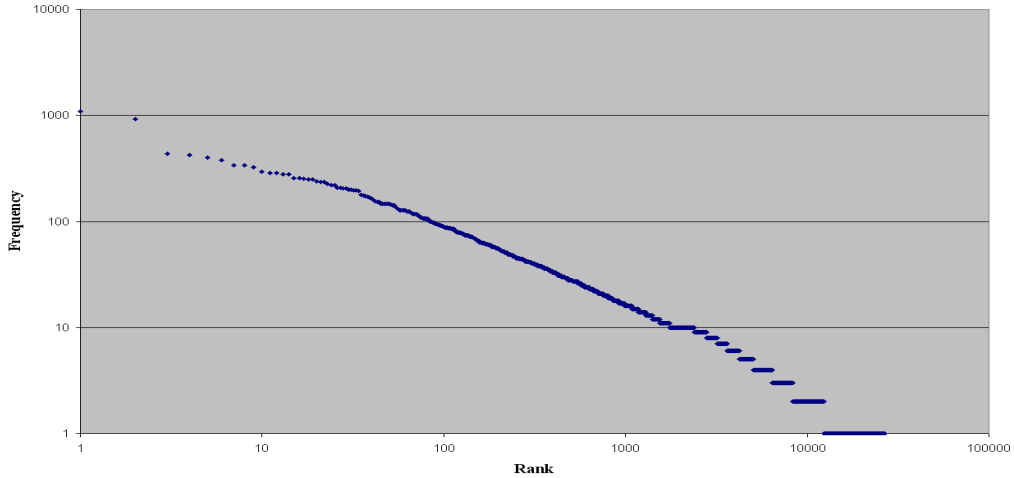


Figure 3-1 Frequency of terms used in Flickr university image groups

3.1.4 Discussion

The results support the assumption of Marlow et al. (2006), Van House (2007), Miller and Edwards (2007) and Cox, Clough, and Marlow (2008) that users of Flickr are primarily

motivated by social factors when tagging images, rather than Golder and Huberman's (2006) and Hammond et al.'s (2005) claims that tagging is primarily for personal benefit. This is an important point to note as it provides further evidence in removing some of the speculation surrounding motivations to tag and the use of applications such as Flickr. The results from this investigation suggest that Flickr users are primarily motivated to tag by social incentives, including the opportunity to share and view other users' images (Marlow et al., 2006). Nevertheless, this result is partly attributable to the choices made when determining the usefulness of certain types of tags. However, it must also be noted that whilst organisational and selfish tags are only of real value to individuals/groups, social and altruistic tags can be of value to both individuals/groups and to the wider Flickr community. So, whilst it can be presumed that users of Flickr are primarily motivated by social factors when tagging images, it could in fact be that they are tagging only for personal benefit whilst at the same time using tags which are social/altruistic in nature. As Hasan et al. (1998) points out, an activity (e.g., tagging) can be carried out as a result of a number of different behaviours (i.e., motivation). However the fact that the images looked at in this study were part of a group would suggest that there is a higher level of sociality involved than images that are not part of a group, therefore the results of this study can not be generalised to all images, or even to images in different types of groups. Nonetheless, the only true way of knowing if 'useful' tags are indeed driven by social motivations is by investigating Flickr users themselves and asking them about their motivations.

The classification scheme that was used for this study needs discussion because no research has been published to date that specifically combines image indexing theory with a tag classification for images in a web 2.0 context. Previous research has tended to focus on image interpretation and meaning in a fine art context, or tag classifications solely focussing on linguistic and informetric aspects, rather than combining the two. Whilst the work carried out by Shatford (1986, 1994) and Golder and Huberman (2006) gave a useful starting point for the development of the classification scheme, the bespoke classification scheme used in this study was not a perfect match for tags used within Flickr.

The fact that no tags were found to fall under the task-organising category (C3) can be attributed to the nature of content stored within Flickr (i.e., images rather than text-based resources). Perhaps there is not the same need for task organisation with images as there is with text as any 'actions' that they may have necessitated (e.g., altering of size, cropping,

manipulation) will have presumably been carried out using image management software prior to being uploaded into Flickr for viewing and storing. However, Picnik, which is an online photo-editing site linked to Flickr, can import images directly from Flickr for editing. Nevertheless this suggests that Flickr publishing may be an end goal rather than an intermediate step (as is the case with some bookmarking websites).

Whilst the tag categories developed for the classification were designed to be exclusive and independent of one another, many tags could lie between categories or equally well in multiple categories (e.g., an image tagged with the word 'Sarah' could be a photograph 'of' a girl named Sarah or 'belong' to a girl named Sarah, or both). Looking at tags alongside their accompanying images should minimise this uncertainty. Nevertheless, the classification decision is subjective.

Although Golder and Huberman (2006) assert that the most frequently occurring tags in a social bookmarking system are likely to be those that are most generally useful, this is not necessarily true for Flickr. The frequency distribution of the tags shown in this study is similar to the frequency distributions seen in natural language, which suggests the usefulness of infrequent tags, as with infrequent words. This point is further corroborated by research carried out by Goodrum and Spink (2001) into image searching on the web. They analysed a data set of 1,025,908 user queries from the Excite image search engine and found that the distribution of highly occurring search terms falls off very quickly when plotted in a log rank-frequency graph, with a very large number of search terms having a frequency of only one. All of the search terms analysed were presumably useful to the user who originally submitted them, regardless of whether or not the terms produced an appropriate selection of retrieved images. A further factor to take into account when looking at frequently occurring tags is that not all groups included in this study may have been university groups. The fact that anyone is able to create a group on Flickr and call it whatever they like means that tags from groups which have nothing to do with higher education institutes may have been analysed as part of this investigation. The top five tags suggest that the majority of groups looked at were groups relating to universities, however.

The number of tags used per image in university groups varied considerably, with 16% of images having no tags, whilst one user had assigned 629 tags to one particular image. This study has not made a comparison between the number of tags per image and the usefulness

of the accompanying tag set for that particular image, but it seems likely that there is a cut off point, beyond which the tags are no longer useful but rather reflect a quirk of the image uploader. That over half of the images looked at had more than four tags indicates that users are tagging thoroughly. No attempt was made in this study to investigate duplicate tagging. A Flickr user who uploads a large amount of images in a particular session could perhaps use a batch process to automatically assign the same set of tags to all of the images uploaded in that particular session resulting in a large number of images all with a high number of tags. However, the tag sets assigned may not necessarily be appropriate for all of the images which were uploaded in that session meaning that the user was casual rather than thorough with their tagging, despite the large number of tags.

Since the tags looked at in this investigation came from images uploaded to university orientated image groups, it is therefore likely that the findings do not apply to other types of image groups within Flickr.

The lack of a second classifier in this study is also a limitation of the results.

3.1.5 Conclusion

In answer to the stated research question, from the results presented in this investigation it seems that tags in university image groups tend to be useful tags that describe images at the B2 level (what they are 'about'). In support of this claim, the majority of tags are of types that are useful to the Flickr community and image uploaders take care to assign multiple tags to their images, at least four for the majority of images. In addition, there is a broad and natural spread in the range and frequency of use of the individual tags, with the exception of the two most popular tags, 'university' and '2006'.

3.2 Flickr's potential as an academic image resource

This preliminary study investigates tags in Flickr in order to determine if Flickr can be used as an academic image resource. The definition of an academic image in this investigation is taken from the Academic Image Co-operative who define academic images as, 'images that respond to widespread teaching and other specialist scholarly needs' (Digital Library Federation, 2009). The Academic Image Co-operative was initiated in

1999 in order to 'develop a scaleable database of curriculum-based digital images' (Digital Library Federation, 2009).

Whilst images have probably always been of value to some academics (especially art historians), there does not seem to be any research that investigates the use and value of web 2.0 images in relation to different academic subject disciplines.

The first preliminary study investigated university groups in Flickr (sets of users who share images around a common theme or interest) and found that many universities have a presence on Flickr (2,374 groups had the term university as part of their group name or description). However, as the study highlights, it is not clear how much of the participation in university groups is on a formal level (e.g., university marketing departments) or on an informal level (e.g., individual students). Nonetheless the study suggests that academic institutions are using Flickr, even if the reasons why are not clear.

McWilliams (2008) examined a specific academic use of Flickr, namely the development of a contemporary academic ceramic image collection by a group at Lewis and Clark College in Portland, Oregon. McWilliams (2008) claims that, 'academic visual resources are in the midst of a shift from traditional slide libraries to reliance upon digital collections' and argues that current digital resources such as ARTstor are, 'closed data silos and can be difficult to work with due to propriety presentation software and copyright restrictions.' ARTstor is a non-profit digital image library for education and scholarship and offers a range of software tools to view, present, and manage images for research and pedagogical purposes (ARTstor, 2011). The group at Lewis & Clark College decided to use Flickr as a way to, 'develop a collection that had high quality images, was open to anyone, included a distributed model for adding and cataloguing images, and was mobile/remixable in the spirit of web 2.0' (McWilliams, 2008). Whilst largely History of Art departments have utilised traditional slide libraries (Williams, 2001) specialist picture libraries cover image genres in many other subject areas (Prior, 2008).

This study is concerned more with the general pictorial analysis of images (i.e., whether the image is of a person, a sunset, a building etc.) and the secondary iconographic level of analysis (which requires an interpretation of the objects in the picture based on a certain level of familiarity with the cultural context) and follows content analysis methodology

approaches as identified by Krippendorff (2004). Note that the image content analysis here differs from content-based image retrieval (CBIR), as the latter is concerned with the retrieval of images using automated systems which generally, 'annotate images based on pixel-level information…and use computer annotated words for retrieval' (Jansen, 2008, p. 82).

3.2.1 Research questions

A web 2.0 image database could be of value to academic institutions for many reasons: as a marketing tool to showcase images of the institution/facilities; as a way for existing students to share images and foster a sense of community; as a way for specific departments/academics to be able to distribute information and images from specific events (e.g., conferences, symposia, workshops, guest lectures, graduation ceremonies); or as a place to house subject specific visual resources which students can draw upon for inclusion in assignments or coursework/reference/inspiration.

This study investigates whether Flickr is used as an academic image resource across a range of subject areas at the general subject level. More specifically, it addresses the following research questions:

- What types of images tagged with academic terms are posted to Flickr and how do they differ between subject areas?
- Are some subject areas more frequently represented in Flickr?
- Does term-frequency analysis of accompanying tags provide any additional insights into the types of images investigated and the reason for their placement?

3.2.2 Methods

Academic subject category selection

In order to investigate Flickr for its use as an academic resource, pre-determined 'academic tags' were selected, and images categorised with those tags were extracted from Flickr using the API. The academic tags were chosen by randomly selecting four recognised academic subject categories from each of the three main ISI citation databases (The Arts and Humanities Citation Index, the Science Citation Index (expanded) and the Social Science Citation Index (expanded)). However, for the Social Science Citation Index, only

three subject categories were randomly selected, and the fourth was chosen as it is the subject area the researcher is most familiar with (Information Science and Library Science). See Table 3-3, column 1 for the ISI subject categories.

Table 3-3 Academic subject categories and Flickr search tags

ISI Citation databases and academic subject categories	Derived subject categories (Flickr tags)
Arts and Humanities Citation Index	
Art	art
Literary theory and criticism	literarytheory OR literarycriticism
Philosophy	philosophy
Poetry	poetry
Science Citation Index (Expanded)	
Anatomy & morphology	anatomy OR morphology
Cell biology	cellbiology
Engineering, mechanical	mechanicalengineering
Physics, nuclear	nuclearphysics
Social Science Citation Index (Expanded)	
Anthropology	anthropology
Education & educational research	education OR educationalresearch
Psychology, social	socialpsychology
Information science & library science	informationscience OR libraryscience

Derivation of searchable tags

It was necessary to derive tags in order to make the retrieval of images more effective (i.e., to achieve higher precision). The derivation process is influenced by Flickr's handling of Boolean operators and characters such as spaces, underscores, ampersands and stars. Whilst Flickr supports Boolean searching, it was not possible to include Boolean operators in the derived terms for those subject categories that included more than one word (e.g., Social psychology). For multiple terms in one concept phrase, Flickr discards spaces, symbols and punctuation and compounds the terms for the process of image retrieval; thus entering the search term 'socialpsychology' returns images tagged with all variations such as: 'social psychology', and 'social-psychology'. For a Boolean 'AND' operator in a search, (e.g., 'social AND psychology') Flickr would retrieve images which had these terms as two separate tags; thus although someone may purposefully tag using separate terms which are in fact part of the same concept, in the interests of consistency, this investigation only includes tags that had been assigned as intentional concept phrases (e.g., 'social psychology', 'social-psychology', 'social_psychology'). OR operators were included in the derived tags for those instances where there was an 'and' in the original

subject category (e.g., literary theory and criticism) as it seemed unlikely that somebody would tag using both of the phrases 'literary theory' and 'literary criticism', but that they would be more likely only to use one variant, hence the OR in the derived subject category would retrieve images that had been tagged with either or both terms, hence cutting out the need for multiple unnecessary searches (see Table 3-3, column 2 for the 12 derived subject categories). Even though Flickr discards spaces and compounds terms for the process of image retrieval, this does not contradict the claim made in the first preliminary study that compound tags are not useful, as the claim relates to the perspective of the image uploader and how their tags relate to their images; rather than from the perspective of how Flickr deals with tags in relation to image retrieval.

Data collection (November 2008)

The 12 derived subject categories were treated as tags and using the Flickr API, the URLs of 4,500 images for each derived subject category were retrieved, or as many as were publicly available, using Flickr's **flickr.photos.search** call method. The number to retrieve was set as 4,500 because Flickr sends back pages of repeated results for requests over 4,500. Whilst this could have been addressed by adding other search parameters such as minimum and maximum upload dates, 4,500 URLs seemed to provide a sufficiently large enough dataset from which to take a random sample. A total of 100 random image URLs were then taken from the pools of 4,500 for each of the 12 categories (or as many as were available if there were fewer than 100 images in total). All of the images' additional tags were then retrieved, again using the Flickr API.

Content analysis of images

The analysis of the images here is concerned with the visible content rather than its iconographic or iconological meaning. However, the images could not be effectively analysed in isolation due to the complex nature of image interpretation and therefore images were looked at within the context of their associated tags and the pages they were situated on. The content analysis scheme also attempts to classify the intentions behind image placement (i.e., mutual experience/absenteeism, self-presentation/self-expression); these intentions are discussed in the Literature Review chapter.

The content analysis scheme (see Table 3-4) is a bespoke iterative scheme drawing upon the work of Kindberg et al. (2005a), Van House and Davis (2005), Shatford (1986, 1994)

and Jörgensen (2004). Drawing on the work of Kindberg et al. (2005a) categories A1, A2, B1 and B2 were developed and drawing on the work of Van House and Davis (2005) category C was developed. Whilst the work of Kindberg et al. (2005a) and Van House and Davis (2005) is based on looking at the underlying reasons and motivations for image capture, these have been adapted here to create classification categories to assess the pictorial content of an image as well as the reason for its placement on Flickr. Kindberg et al.'s (2005a) notions of *mutual experience* and *absenteeism* were felt to perfectly reflect the formal/informal divide on Flickr in the uploading of images to either, 'enrich a mutual experience with those who were present at the time of capture', or, to 'share or communicate an experience with absent people.' Van House and Davis's (2005) notion of *self-presentation* and *self-expression* was chosen as an important image category in keeping with the playful and experimental nature of Flickr. Self-presentation/expression may apply to self-portrait images or pictures of one's belongings or space, or images that 'express one's own view of the world' (Van House & Davis, 2005).

Shatford (1986, 1994) and Jörgensen (2004) informed the development of categories D and E respectively. Shatford's (1994) description of an Exemplified image attribute is appropriate for Flickr because popular images can often be 'images of other images', as Shatford puts it, 'an image may be an etching or a photograph or a poster, which is quite different from an image that represents, or is of, etchings or photographs or posters'. Jörgensen's (2004) visual indexing thesaurus, which was intended for the indexing of images across diverse subject domains, included the top-level category of Abstract concepts (e.g., images of an abstract nature) and this category is further expanded here to include images denoting a theme, an atmosphere, genre, the utilisation of symbolism, or visual properties beyond the realms of other classification categories.

Table 3-4 Image content analysis scheme

Image content analysis scheme				
Mutual experience (Kindberg et al. 2005)	**People** (informal)	Intent to share the image with people who are **known**	Primary focus of image is 'people' (e.g., course night's out/parties/personal graduation shots). It is evident that the intent of the image is to share with people who are known/familiar to the image owner (e.g., people within the image may be tagged/accompanying tags indicate that the image represents a shared experience)	**A1**
	Places (informal)		Primary focus of image is 'places' (e.g., buildings/scenery perhaps from: field trips/course visits/group exhibitions). It is evident that the intent of the image is to share with people who are known/familiar to the image owner (e.g., accompanying tags may be, 'philosophy field trip')	**A2**
Absenteeism (Kindberg et al. 2005)	**People** (formal)	Intent to share the image with people who are not explicitly **known**	Primary focus of images is 'people' where an assumption can be made that the people in the image are not personally known to the image owner (e.g., generic shots of people at conferences/in lectures/generic graduation shots/gallery or exhibition visits)	**B1**
	Places (formal)		Primary focus of images is 'places' where an assumption can be made that the primary intent of the image is not to share with people who are personally known to the image owner (e.g., university buildings/conference venues/science labs/gallery, museum or exhibition shots).	**B2**
Self-Presentation / Self-Expression (Van House & Davis, 2005)	**Documenting one's work / Self-exhibition**		Primary focus of image is the documentation or exhibition of oneself or of one's work (e.g., artwork: photograph, painting, ceramic / images of a finished project / self-portrait images). The accompanying image tags indicate either the ownership of the work (e.g., 'mywork', 'assignment_semester1') or indicate that the image is meant for self-exhibition (e.g., 'me at the gym', 'me posing for the camera').	**C**
Exemplified image (Shatford, 1986, 1994)	**Documenting the work of others / Exhibiting of 'items'**		Primary focus of image is of another person's work (e.g., artwork: photograph, painting, ceramic, graffiti). The accompanying tags indicate that the work is by someone other than the image owner (e.g., an image of a painting hanging in a gallery tagged as, 'Van Gogh', images of street graffiti, images of books where the title/author name are on display, images of 'artefacts' in museums, or reprographics of work such as diagrams/graphs)	**D**
Abstract concepts (Jörgensen 2004)	**Object/item/ visual element**		Primary focus of image is of portraying abstract concepts (e.g., the item may contain objects/items/visual elements – it is not possible to determine who the work belongs to, but where there appears to be an abstract relationship denoted between the image and tag, e.g., blurry image of a book tagged as 'literary criticism' / an image of a sunset which accompanies a typed poem).	**E**
Non-relevance			e.g., an image of a band tagged as, 'philosophygig2008'/ images tagged by username, 'MrPhilosophy'.	**F**
Unable to determine			Instances where the relationship between the image and its tag(s) cannot be determined.	**G**

Categories D and E make no judgements about whether or not an image was uploaded to Flickr with the intent to share with friends/family or other users. Categories F and G were developed iteratively after the analysis process had begun, and whilst they do not assess image content, they were a necessary element of the image content analysis scheme to be able to deal with instances where images were clearly either not relevant to this investigation (i.e., category F) or where images bore no visible relationship to the pre-determined tags (i.e., category G).

Term-frequency analysis of associated tags

In addition to the derived subject category search terms (i.e., tags) used to retrieve the images in the sample, all of the additional tags that accompanied these images were also retrieved. A term frequency analysis was then conducted on the retrieved additional tags for each category.

3.2.3 Results

A total of 4,695,530 images were identified using the Flickr API across the 12 subject categories. Art was the most common derived subject category out of the 12, and it accounted for 94% of the images across the 12 subject categories (see Table 3-5 for the total number of images per subject category). The final sample consisted of 980 images.

Table 3-5 Total number of images available per subject category

Derived subject categories (tags)	Total number of images tagged	Images retrieved	Sample used
art	4,416,037	4,500	100
literarytheory OR literarycriticism	46	46	46
philosophy	12,287	4,500	100
poetry	81,682	4,500	100
anatomy OR morphology	14,525	4,500	100
cellbiology	42	42	42
mechanicalengineering	523	523	100
nuclearphysics	66	66	66
anthropology	14,237	4,500	100
education OR educationalresearch	155,638	4,500	100
socialpsychology	26	26	26
informationscience OR libraryscience	421	421	100

Content analysis of images

Across the 12 subject areas as a whole, 300 out of the sample of 980 images (31%) fell into category D (documenting the work of others), and this was closely followed by category C (the documentation of one's own work/self-exhibition), which accounted for 182 (18%) of the total images. The content analysis shows that each of the 12 derived subject categories has distinct differences in the kinds of images that are uploaded to Flickr. Figure 3-2 shows the overall percentage of images that fell into the nine separate classification categories for each of the 12 derived subject categories.

The results were then analysed for significance using a chi-squared test. The differences between the classification categories were highly significant ($p < 0.001$). In order to make this test valid all cell expected values have to be at least five. To achieve this, the subjects with less than 100 image URLs available were removed from the analysis, and the A1 and A2, and B1 and B2 classification categories were both merged. However as these were merely subcategories of the same overall category of image, this did not impact negatively on the conclusions that could be drawn from the results.

Arts and Humanities subjects

(art, literarytheory OR literarycriticism, philosophy, poetry)

The Arts and Humanities subjects were by far the most represented subject area on Flickr, with 94% of the total images coming from art alone. Images tagged with 'art' were mainly in categories C and D (the documentation of one's own work and that of other's) and this tended to be images from exhibitions that had been attended where the focus of the image was on specific art work, images of street graffiti, and also images that were clearly documenting the work of the image owner, such as images of paintings and illustrations. Images tagged with 'literary theory' or 'literary criticism' tended to be images of an abstract nature such as collections of words, and tag clouds relating to various works of literature. Conversely, images tagged with 'poetry' were predominantly images that fell into the A1 category (people: informal) and these were mainly images of known people/friends who had attended intimate poetry reading events or poetry slam competitions (predominantly in Los Angeles).

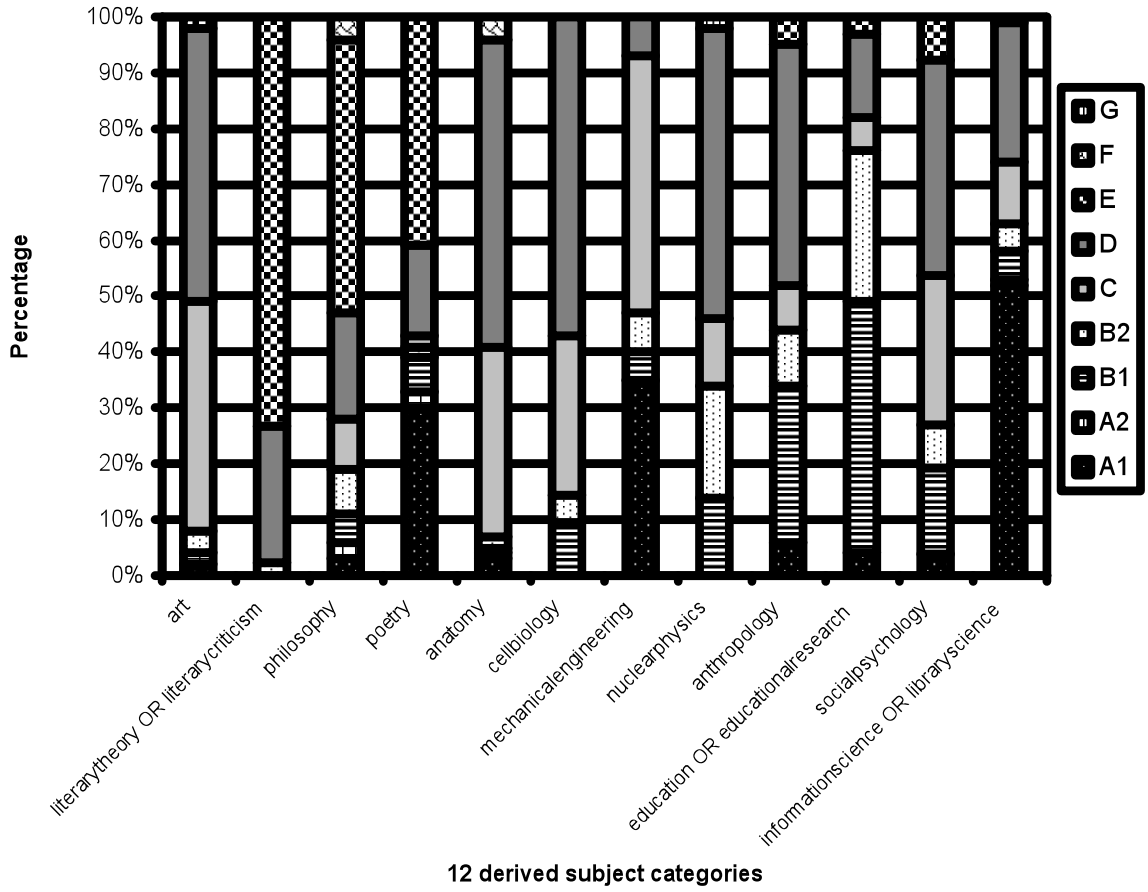


Figure 3-2 Image classification for each of the 12 derived subject categories

Science subjects

(anatomy OR morphology, cellbiology, mechanicalengineering, nuclearphysics)

Interestingly, images tagged with 'anatomy' or 'morphology' fell mostly into the C and D categories and were mainly images documenting one's own work such as sketches and paintings of anatomical parts, or anatomical illustrations photographed from books. Images tagged with 'cellbiology' were mainly images of cell clusters taken through a microscope. Similarly, images tagged with 'mechanicalengineering' also had a high proportion of category C images that were intended to document finished project work. However, there was also a high proportion of category A1 images, consisting mainly of group shots from course nights out and graduations.

Social Science subjects

(anthropology, education OR educationalresearch, socialpsychology, informationscience OR libraryscience)

Images from both the anthropology and education subjects were more represented in the B1 category than any subjects from the Art and Humanities and Science subjects. These were mainly formal images of people attending conferences (as in the case of anthropology) or shots of people on educational visits or in classrooms (as in the case of education). Education also had the highest instance of B2 images across the 12 subject areas, and these tended to be images of school and university buildings taken from the online virtual world of Second Life. Images tagged with 'informationscience' or 'libraryscience' had the highest level of A1 images across all 12 of the subject areas, and these mainly consisted of informal photos of friends and family taken at graduation ceremonies.

Term frequency analysis of associated tags

A term frequency analysis was carried out on all of the tags that accompanied the sample of 980 images. Table 3-6 shows the top five tags for each of the 12 derived subject categories.

Table 3-6 Top five additional tags for each of the 12 derived subject categories

	art	literarytheory OR literaryciticism	Philosophy	poetry	anatomy OR morphology	Cellbiology	mechanicalengineering	nuclearphysics	anthropology	education OR educationalresearch	socialpsychology	informationscience OR libraryscience
1	gallery	humanities	art	slam	body	cells	university	universitty	mexico	school	mind	talk
2	street	t-shirt	spiritual	LA	art	science	graduation	alberta	museum	children	bites	of
3	graffiti	sharpie	religion	photo	illustration	hematopoesis	formula	particle	tradition	students	zone	university
4	contemporary	halloween	belief	poem	human	blood	trades	edmonton	culture	teaching	theory	graduation
5	design	literature	university	love	medical	microscope	camosun	CERN	ethnography	secondary	system	rachel

3.2.4 Discussion

The results from this investigation confirm that Flickr is being used as an academic image resource, although the variation in the number of photos available tagged with the derived subject category descriptors and the content of these images suggests that it is more suitable for some academic disciplines and objectives than others. Comparing a tag that

retrieved 4 million images (art), with a tag that retrieved 26 images (social psychology) has obviously skewed the results somewhat, but it is nonetheless interesting to make a first attempt at trying to find out how different subject disciplines are using images on Flickr and the extent of their use.

Two of the main benefits of a web 2.0 site such as Flickr are the large number of images in the system and the potential for multiple users to tag images, thus providing additional entry points for future retrieval. However, such user-centric systems mean that no control is exerted over the tags that are used, which may partly explain the variation in the number of photos retrieved. Using the derived subject category tags for image retrieval was found to have a high level of precision, with the vast majority of images being clearly identifiable as related to their tags and of an academic nature (only four images out of the sample of 980 were found to fall into categories F and G). However, it could be that a high proportion of the images not included in this investigation may have been tagged with 'informationscience' for example, but may have borne no identifiable relationship to information science (as defined by the content analysis scheme outlined in Table 3-4). There may also be many images in Flickr that are relevant to information science, but which have not been tagged with the terms used here. This investigation cannot therefore draw any conclusions about the level of recall (i.e., the total number of relevant images), or the differences in recall between different subjects. It is therefore worth noting that a further limitation of this investigation was the omission of the use of closely related terms (e.g., 'information studies', 'library studies') in the retrieval of images. This was done to ensure that all subject disciplines were being assessed by an equal number of terms (i.e., tags) and taking these terms from the ISI citation indexes should prevent any author bias (although some subjects did have synonyms included, but these were explicitly stated in the ISI databases). However, the terms taken from the ISI citation indexes still created a somewhat unbalanced mixture of broad and narrow subject terms (i.e., art is a much broader term than cell biology) and this factor will have also skewed the results.

Whilst a large sample of random images were initially retrieved (4,500 for each derived subject category) in order to minimise the likelihood that the images retrieved belonged to the same user, this was not always possible for subject areas that had very few images uploaded. This can be seen in the cases of literarytheory/literarycriticism and socialpsychology. Only 46 images in Flickr had been tagged with

literarytheory/literarycriticism, and the skewing of the associated terms can be attributed to most of the images having been uploaded by the same user and relating to the same event (a t-shirt covered in writing taken from works of literature, taken at Halloween and tagged with 't-shirt', 'sharpie', 'Halloween' and 'literature'). Similarly, only 26 images in Flickr had been tagged with socialpsychology and these had also been uploaded by primarily one user, thus heavily skewing the associated tags. Whilst the associated tags for anthropology may appear to have been uploaded by the same user(s) due to the prominence of the associated tag 'Mexico', this is not the case. The 50 images in the anthropology sample had been uploaded by 31 different Flickr users, each with no apparent connection to the other. The popularity of the tag 'Mexico' is perhaps indicative of the US bias in Flickr and the relative closeness of Mexico to North America provides an ideal location for anthropologists to study small-scale societies in close proximity to one another. Similarly, the terms 'graffiti' and 'street' were the second and third most popular terms associated with the subject category of art, and whilst a traditional picture library is unlikely to be dominated by images of street graffiti, their popularity in Flickr is an indication of the growing acceptance of graffiti as an art form. Flickr therefore provides a platform for the documentation and showcasing of such artwork that may not be as commonplace through traditional means such as a gallery setting. This particularly illustrates the contemporary value of Flickr.

Some subject terms are more widely used than others. For example, whilst 'information science' is a unique term that is likely to only be used in relation to its academic meaning, the term art has a much wider spectrum of uses. The tag art could accompany a photograph of a child's drawing or a photograph of a famous painting but it seems that a child's drawing would be rarely valuable for art in the academic sense. This variation in term usage perhaps therefore creates a lower level of precision in the results for some subject categories. It also probably contributes to the noticeable differences in the number of images that are tagged with the 12 derived subject categories, with art alone accounting for 94% of the total images retrieved.

In addition to the above, the extent to which a given image can be classed as 'academic' is more widely questionable. For 'mechanical engineering' there were many photographs from graduations and although such images can be tagged with the subject category of the degree in question (i.e., mechanical engineering) these are not 'academic images' in the

sense of being useful within the academic subject, unless for allowing people to gain an insight into academia.

A further limitation of this investigation is that it assumes that for Flickr to be viewed as an academic resource, it should contain images that have been tagged in a manner that can be classed in some way 'academic'. This investigation does not take into account that academics may use Flickr to search for images that bear no apparent connection to their subject discipline, as Besser (1990, p. 788) states:

> *A set of photographs of a busy street scene a century ago might be useful to historians wanting a 'snapshot' of the times, to architects looking at buildings, to urban planners looking at traffic patterns or building shadows, to cultural historians looking at changes in fashion, to medical researchers looking at female smoking habits, to sociologists looking at class distinctions, or to students looking at the use of certain photographic processes or techniques.*

This single image may have only been tagged with the term 'street' and it may have been uploaded to Flickr by the offspring of an elderly family member. Such an image would have been ignored in the current investigation, but could be of value to academics from many different disciplines. This limitation could be addressed in the future by interviewing academics to discuss their use of image sites such as Flickr and image libraries generally.

3.2.5 Conclusion

The results of this investigation illustrate that Flickr can be of use to some academics as an image resource, in the sense of serving as a database in which subject-relevant images may be searched for/consulted/viewed/used in whatever way necessary (copyright permitting), although this is highly dependent upon subject area and the reasons behind system use. Moreover, as the discussion above illustrates, Flickr may meet academics' individual needs for images that are not necessary subject-specific (e.g., graduation/course specific images which may be used for promotional purposes).

Whilst images documenting one's own work and that of others proved to be the most popular type, this varied greatly between subject areas. The results suggest that images

from arts based subjects lend themselves more easily for inclusion on Flickr, and this is in keeping with traditional uses of picture documentation and slide libraries. Finally, the term-frequency analysis of additional tags illustrated the potential contemporary value of Flickr.

Perhaps most notable from this exploratory study into the use of Flickr as an academic image resource is the formal/informal divide which exists in the types of images that are uploaded to the system. Within any given subject category, images of friends on nights out sit alongside more serious shots of famous scientists and renowned architecture. Such diversity means that Flickr may be a far richer source from which images can be drawn than traditional academic slide or picture libraries.

3.3 Overall summary

Both preliminary studies made successful use of the Flickr API for extracting image and tag data, thus confirming the suitability of the Flickr API for use in the principal investigation.

The first preliminary study developed a tag classification scheme for use with images and tags in Flickr, although as the discussion section highlights, some slight revisions are necessary to the scheme to make it a better fit for use with Flickr. Whilst both studies produced some interesting findings in terms of the use of tags and the use of Flickr outside of the context of amateur photography, they also reiterated that whilst tag analysis can give an indication as to the reasons behind uploading images to Flickr, this is a limited viewpoint and an investigation that seeks to understand motivation has to include the interrorgation of Flickr users themselves as well as looking at their images and tags.

4 Research design

4.1 Introduction

This chapter outlines the research questions that arise from the overall aim and objectives of the thesis. In order to answer the research questions proposed it is necessary to develop a suitable research design to guide the investigation. The research design encompasses the methodology (i.e., quantitative or qualitative) and the methods adopted (e.g., experiment, survey, grounded theory, case study). The methodology does not have to dictate the research method, as surveys can be either quantitative or qualitative, or a combination of the two. The aim of the investigation does however dictate the research method to a certain extent, as certain kinds of research are better suited to certain research methods than others. There are nonetheless a number of different research methods that could have been adopted in order to answer the research questions of this investigation. This chapter therefore gives an overview of the suitable research methods that could have been utilised before explaining the decision for the final choice.

4.2 Research questions

In order to fulfil the aim and objectives of this thesis the following overarching research questions were formulated:

1. What motivates users to upload their digital images to Flickr?
2. What motivates users to tag their images in Flickr?
3. How do users tag their images in Flickr?
4. What effect does motivation to upload and tag have on the types of tags users assign to their images in Flickr?

In light of the gaps identified in the literature review, a series of sub-questions were also developed in order to explore additional factors that may affect a Flickr user's tagging practice:

5. Does the number of groups a user is a member of affect their tagging practice?
6. Does the number of contacts a user has affect their tagging practice?

7. Does the number of publicly available photos a user has affect their tagging practice?
8. Does age affect a user's tagging practice?
9. Does gender affect a user's tagging practice?
10. Does the kind of photographer a user classes themselves as affect their tagging practice?
11. Does country of origin affect a user's tagging practice?
12. Does the type of Flickr account a user has (i.e., basic or pro) affect their tagging practice?

4.3 Hypotheses

Research hypotheses are a statement of expected results and they attempt to predict or explain a phenomenon (Simon, 1988, p. 37). The main aim of this thesis is to compare what motivates people to upload and tag their images in Flickr with how they tag their images in practice, and in light of the literature reviewed, the following two main hypotheses were formulated:

H1	There will be a relationship between motivation to upload images to Flickr and tagging practice
	There are a number of studies that indicate that motivation to upload images in Flickr is likely to affect tagging practice (Van House et al., 2004; Van House, 2007; Nov, Naaman & Ye, 2009a, 2009b).
H2	There will be a relationship between motivation to tag images in Flickr and tagging practice
	There are a number of studies that indicate that motivation to tag images in Flickr is likely to affect tagging practice (Marlow et al., 2006; Zollers, 2007; Ames & Naaman, 2007; Nov, Naaman & Ye, 2008).

In conjunction with the sub-questions that were developed, a number of additional hypotheses were developed:

H3	The number of groups a user is a member of will affect their tagging practice
	Research that has looked at Flickr groups has tended to do so from the perspective of group characteristics such as, length of existence, number of members, total photos posted, total number of discussions, group topics (Negoescu & Gatica-Perez, 2008; Negoescu et al., 2009; Cox, Clough, & Siersdorfer, 2010). However, Negoescu and Gatica-Perez (2008) state that Flickr users who do not upload images to groups are likely to have different usage patterns, and it is therefore likely that tagging practice may also be affected by group membership. Nov, Naaman and Ye (2008, 2009a, 2009b) suggest that

	tagging is associated with motivation, and motivation is closely linked to social presence and group membership.
H4	The number of contacts a user has will affect their tagging practice
	Lerman, Plangprasopchok and Wong (2007) assert that contacts in Flickr are an expression of a user's interests for using the service. Similarly, Prieur et al. (2008) state that contacts indicate a user's intention to interact socially with Flickr. Nov, Naaman and Ye (2008, 2009a, 2009b) suggest that tagging is associated with motivation, and motivation is closely linked to social presence and number of contacts.
H5	The number of public images a user has will affect their tagging practice
	Nov, Naaman and Ye (2008) claim that the number of images a Flickr user has is likely to drive their tagging behaviour as more images create a more pressing need to tag.
H6	Age will affect tagging practice
	Argamon et al. (2007) found that age significantly influenced writing styles in online blogs. It would be advantageous to know if these differences are also reflected in the use of tags that user's assign to their images in Flickr.
H7	Gender will affect tagging practice
	Argamon et al. (2003) found significant differences in the formal writing of males and females. It would be advantageous to know if these differences are also reflected in the use of tags that user's assign to their images in Flickr.
H8	The kind of photographer a user classes themselves as will affect tagging practice
	Ding et al. (2009) found that type of photographer affected the tagging practice of Flickr users. Additionally, Cox (2008) reasons that as Flickr encompasses all forms of photography, different types of photographers are likely to have different reasons for using Flickr.
H9	Country of origin will affect tagging practice
	Dotan and Zaphiris (2010) found that Flickr users from five different countries tagged differently. It is therefore likely that these differences will also be reflected in a larger sample than five different countries.
H10	Whether or not the user has a pro account will affect their tagging practice
	Negoescu and Gatica-Perez (2008) and Dotan and Zaphiris (2010) state that sharing behaviour in Flickr is likely to be influenced by whether or not the user has a pro account.

4.4 Potential methods

Investigations that look at human beliefs and behaviour are generally best suited to either case study or survey approaches. These approaches specifically aim to gather information about 'the characteristics, actions, or opinions' of a given population of people (Pinsonneault & Kraemer, 1993). As this thesis is concerned with investigating both actions (how people tag) and opinions (why people think they tag and upload), it seemed most appropriate to consider both case study and survey approaches as possible research methods.

Case studies are empirical inquiries that investigate contemporary phenomena within their real-life contexts (Yin, 2002). Case studies can combine qualitative and quantitative data collection, although they are often associated with the use of qualitative in-depth

interviews, documentation review and observation. By their nature, they are usually inductive, meaning that the phenomenon is investigated holistically via qualitative methods in order to provide rich in-depth knowledge of the case and theories are then generated afterwards. With intrinsic case studies it is the understanding of the case that is paramount rather than the understanding of an overall phenomenon, whereas instrumental case studies focus on a number of cases in order to investigate a particular phenomenon. Whilst an instrumental case study approach would allow for richness and depth of understanding in investigating and determining a limited number of users' motivations for uploading and tagging their images in Flickr, this research design was rejected for two main reasons: Firstly, the time consuming nature of case study research is likely to negatively impact on the number of participants willing to take part in the investigation. Flickr encompasses a global set of users, and although case studies can be carried out remotely via the use of telephone/Skype interviews and the reviewing of online image and tag data, it would still require time investment on behalf of the participants and it seems unlikely that participants in countries other than the UK would agree to take part in such an investigation if they do not personally know the researcher. Secondly, as is the nature of a case study approach, only a limited number of participants would be investigated, meaning that findings cannot be reliably generalised. As the rationale for this thesis is concerned with being able to shed light on how Flickr is perceived and used overall by its users so that system designers will be better placed to help and guide users in getting the most from their experience of the system in question, it would be counterproductive to adopt a research design that would not allow the overall aim of the thesis to be met.

In contrast, survey research generally results in a study that has utilised a somewhat representative sample of the research population (Pickard, 2007, p. 95). The aim of survey research is to study relationships between specific variables in order to test hypotheses or to describe certain characteristics of the population (Pickard, 2007, p. 95). Descriptive surveys seek to describe a situation and/or look for trends and patterns within the sample group whereas explanatory surveys often seek to establish cause and effect relationships. As surveys tend to take place in natural settings it is impossible to establish definitive cause and effect relationships, but probable links between variables can be identified. The structure of an explanatory survey is therefore well suited in an investigation into how user motivation affects the types of images and tags uploaded to Flickr. The use of large-scale surveys also allow for generalisations to be made from findings (Pickard, 2007, p. 95). The

utilisation of automatic data collection techniques (discussed in section 4.4.2) provides additional methods for large-scale quantitative data to be collected, which allows for even greater generalisation of the results. Given that Flickr is currently estimated at having 51 million members (Yahoo, 2012), it is more appropriate to aim for research findings that can be generalised to such a large population of users.

Based on the desire to obtain large-scale quantitative data that would allow for generalisations to be made, and also based on the underlying rationale for this thesis, a survey method design facilitated by automatic data collection was chosen.

4.4.1 Surveys

Surveys have long been regarded as the primary method of measuring attitude and behaviour (Czaja & Blair, 1996, p. 1) and they aim to obtain information that can be analysed to identify patterns and to make comparisons (Pickard, 2007, p. 95). Surveys can encompass: mail questionnaires; telephone interviews; face-to-face interviews; and focus groups (Czaja & Blair, 1996, p. 31). The pervasiveness of electronic media has led to rapid growth in the use of online surveys (Malhotra, 2008) as a way of measuring both online and offline behaviour (Walther, 1999).

Due to the fact this research project aimed to investigate user motivation and was specifically focussed around a web-based set of users, an online survey method was the most appropriate approach. This investigation aimed to target a large random probability sample of Flickr users, and it is for this reason that an online survey was chosen. It would have been logistically impractical to try to interact offline with a large random sample of users who were likely to be spread across the world. Due to the geographically disparate nature of the potential sample of users and the costs associated with travelling, both a focus group and face-to-face interviews were ruled out. Due to the kind of sample (random probability) it was felt that either telephone or Skype interviews would impact negatively on the potential sample size. Telephone and Skype interviews are more personal in that the interviewer and interviewee are actually speaking to each other (and potentially seeing each other in the case of Skype); respondents would be much less likely to agree to this when they don't know the interviewer personally and they are likely to view such a request as an intrusion on their time. Potential respondents are also unlikely to disclose their postal address to someone they don't know personally and they are therefore likely to ignore an

unsolicited request to disclose such information for the purposes of a questionnaire. All of these factors are likely to significantly reduce the amount of Flickr users who would be willing to take part in the survey, and it is for these reasons that an online questionnaire was chosen as the most appropriate research method to adopt for this investigation. Indeed it could be argued that such a community of people only exists within the realms of cyberspace (Wright, 2005). Wright (2005) also suggests that internet communities often welcome studies by researchers as many of them are interested in how their community is perceived by others.

4.4.1.1 Advantages of questionnaires

The main advantages of an online questionnaire is that they allow quick and easy access to a large amount of individuals in distant locations, and that they also can support automated data collection, which reduces researcher time, effort, and cost (Wright, 2005). Online questionnaires also allow the inclusion of intricate graphics and multimedia, which can often help to increase response rates (Malhotra, 2008).

Online questionnaires also have some of the same advantages of traditional paper based questionnaires. Interviewer bias is reduced compared to survey methods, such as face-to-face interviews, and there is also less pressure on the respondent to give an immediate response; they can answer in their own time and at their own pace (Gillham, 2007, p. 7). There is also a standardization of questions as all respondents will be given exactly the same questionnaire to complete, whereas in an interview or focus group discussions can get diverted and certain questions will be discussed in more depth with some respondents more than others (Gillham, 2007, p. 7).

4.4.1.2 Disadvantages of questionnaires

There are a number of disadvantages with survey research in general, and these disadvantages are also present with online questionnaires. One of the main drawbacks is that people can very easily lie in questionnaires or perhaps answer questions in a way that they think the researcher wants to hear, or even in a way they think the researcher does not want to hear, thus purposefully trying to sabotage the results. In order to minimise this potential problem, the Likert scale to measure respondents' motivations for tagging included pairs of questions, and it was expected that respondents would answer similarly

on each pair (see Chapter 5). Nonetheless, even if pairs of questions are answered similarly, there is still no way of checking the quality or sincerity of the answers. In their study on face-to-face versus web surveying, Heerwegh and Loosveldt (2008) found that respondents in web surveys produced data of lower quality than in face-to-face surveys. They were shown to produce, 'a higher "don't know" response rate, to differentiate less on rating scales, and to produce more item non-responses than face-to-face survey respondents.' The authors reported that multitasking could also prove to be a distracting factor in web surveys, 'respondents might have a number of programs running concurrent with the web browser opened for the purpose of answering the web survey and/or could be accessing different web sites at the same time' (Heerwegh & Loosveldt, 2008).

There are also problems surrounding design, question wording, question order, and the fact that misunderstandings cannot be corrected (Toepoel, Das, & Van Soest, 2008); the use of a pilot study is the best way to minimise these potential problems (Presser et al., 2004) (see chapter 5 for information on the pilot study). However even when questions have been carefully worded and pre-tested, question wording can still nonetheless have a major effect on the answers respondents give (Couper, 2000) and respondents can misunderstand a closed question without providing any indication of having done so (Presser et al., 2004).

Another problem is that relatively little can be known about the characteristics of people in an online sample and the person to whom you sent the questionnaire to might not be the person who completes it (Wright, 2005). However, as this questionnaire was sent directly to users via their Flickrmail accounts, it seems unlikely that anyone else would have ended up completing the questionnaire for them.

A common reported disadvantage of using online questionnaires is the limited and biased population of users (age, income, gender and race) and the fact that not everyone has access to the web. However, as this study is specifically aimed at the Flickr community and therefore people who presumably have access to the internet, this disadvantage should not be a problem. Such a community does not exist anywhere else (Wright, 2005) and therefore an online method is the natural choice. However, it could be that only people who are fairly active on Flickr will be more likely to complete the questionnaire thus potentially biasing the sample. It could also be that people in certain countries could have limited internet access, slow bandwidth, unreliable connections etc., and in some countries

connect-time costs may be more of an issue, and this may reduce their likelihood of spending time participating in an online questionnaire (Couper, 2000).

The other factor to consider in the use of a questionnaire in this investigation is that a questionnaire only measures the beliefs and opinions of the respondents (i.e., their motivations for uploading and tagging images). A questionnaire can't measure actual behaviour (i.e., how the respondents tag their images). Whilst an experimental design could have been adopted whereby a tagging exercise was set up for a sample of respondents to complete with the aim of determining how the users tag images, this was not appropriate for a number of reasons. Firstly, an experiment such as this would have been conducted in a contrived environment compared to the user tagging their images in their normal home environment, and the experiment is therefore likely to have suffered from experimenter effects where the presence of the researcher observing them affects their behaviour; or situational variables may have also been a problem depending on where the exercise was conducted – heat, lighting, noise could have impacted on the results. Secondly, sampling bias would have impacted negatively on the use of such an approach. Flickr has an international spread of users, and the use of an experimental design to investigate tagging would have limited the participants that could take part to people both from the UK, and also people possibly from the same city as the researcher. This would have resulted in a biased sample of participants, meaning that the results would not be able to be generalised. Lastly, there would also be the issue of selecting appropriate images for the participants to tag. Asking participants to pre-select a selection of their own images that they had uploaded to Flickr but had not yet tagged would be an awkward procedure and some people may prefer to tag their images as soon as they are uploaded rather than having to wait. On the other hand, giving the participants random images to tag would have been completely counterproductive as the images would not personally mean anything to them and would therefore not be linked to their motivation for using Flickr, or their motivation for tagging their images.

4.4.2 Automatic system data collection

Straub (2004) advises using system data if possible as a way of avoiding common method bias. Common method bias can be a problem if the same instrument is being used to test both the dependent variable (DV) and the independent variable (IV) in a study (e.g., using

a questionnaire to ask respondents both why they tag (the IV) and how they tag (the DV)). Using comparative sources is a method to reduce this bias. As this investigation was concerned with comparing user perceptions (i.e., their motivations) with user behaviour (i.e., how they tag), extracting system data relating to how users tag their images would be the most reliable method of avoiding method bias.

An automatic approach utilising system data from Flickr was therefore used for both the sample selection in the principal investigation (see section 6.1.1.3), and also as a way of collecting additional user data from Flickr, such as images and their accompanying tags and account information. This was achieved via the use of the Flickr API (Application Programming Interface).

4.4.2.1 The Flickr API

APIs provide a mechanism for third party software to interact with and make use of the data contained within a website without having to access the underlying source code or pay any royalties to the site creators (Anderson, 2007). APIs have helped web 2.0 services to develop rapidly (Anderson, 2007). The Flickr API is a powerful and effective way to interact with Flickr accounts and there have been numerous studies that have used the API to extract various forms of data from the site, including user account data (Mislove et al., 2008; Negoescu & Gatica-Perez, 2008; Nov, Naaman, & Ye, 2008), image and tag data (Lerman & Jones, 2006; Lerman, Plangprasopchok, & Wong, 2007; van Zwol, 2007; Prieur et al., 2008; Angus, Thelwall, & Stuart, 2008; Angus, Stuart, & Thelwall, 2010; Cox, Clough, & Siersdorfer, 2010; Dotan & Zaphiris, 2010; Rorissa, 2010), and also to create novel mash-ups and automated systems (Lerman, Plangprasopchok, & Wong, 2007; McWilliams, 2008).

In order to use the Flickr API an API key must first of all be obtained so that any activity carried using the API can be tracked and associated to the account it is linked to. API keys can be easily obtained via the Flickr site (although a Flickr account needs to have been set up first). Flickr allows use of the API for experimentation and for the production of non-commercial products. Flickr has a documentation page that lists all of the API call methods available (http://www.flickr.com/services/api/). The call methods are individual codes that tell Flickr what information is requested (e.g., the URLs of the 100 most recently uploaded

photos, a list of all the photos with a specific tag etc.). The various call methods can be selected and they will interact with the API within the browser itself, or bespoke programmes can be created that will interact with Flickr remotely, either way Flickr will relay the data requested back in a specified format (e.g., XML, JSON).

4.5 Summary

As mentioned earlier in this chapter, given that Flickr is estimated at currently having 51 million members, this investigation aimed to obtain large-scale data that would allow for generalisations to be made to the entire Flickr population. A quantitative methodology was therefore adopted via the use of a questionnaire, utilising additional automatic data collection techniques to gather information about what users do in Flickr.

This investigation is rooted within a post-positivist deductive research paradigm, whereby the methodology and approach adopted emerged from the literature and was designed in light of existing theory, data is then collected and analysed in order to test proposed hypotheses as developed in light of the literature. Deductive research is theory testing, compared to inductive research, which is theory generating (Blaikie, 2000, p. 1). This theory testing approach is situated within a post-positivist paradigm in that thoughts as well as directly observable actions are being measured (i.e., people's claimed motivation for tagging as well as how they actually tag), and it is understood that there is the possibility of error in observing this phenomenon (e.g., Flickr users may lie in the questionnaire, results could be wrongly interpreted, and generalisations will not necessarily be able to be made to every single Flickr user in the wider Flickr population). In contrast a solely positivist paradigm would argue that only things that can be directly physically observed and measured can be studied and that a single truth must be concluded (Trochim, 2006).

5 Pilot study

A pilot study was needed to empirically test the use of a questionnaire on a limited real-life sample of Flickr users before distributing it to the larger principal sample. Pre-testing a questionnaire is the only way to evaluate whether there are any problems with it (Presser et al., 2004). Gillham (2007, p. 42) advises that a pilot study should simulate a main study, but with the use of fewer people; the people used should nonetheless be of the same kind as the final target group (Schwab, 1999, p. 34). The pilot study included a sample of 33 Flickr users, which is broadly the same kind as the sample of people in the final target group other than the slight European bias of the pilot sample.

The pilot study did not make use of automatic data collection via the Flickr API or extensive content analysis, as its purpose was to merely test the questionnaire instrument for ease of use and appropriate question wording and design.

5.1 Motivations for image uploading and tagging on Flickr

The pilot study formed the basis of a publication, *Motivations for image publishing and tagging on Flickr* (Angus & Thelwall, 2010) and it investigated motivation for image uploading and tagging as well as investigating if people hope to make a commercial gain from images they upload to Flickr. The main purpose of this study was to act as a pilot study for testing the questionnaire that would be subsequently used to investigate why people upload and tag their images in Flickr in the principal investigation.

5.1.1 Research questions

This pilot study was designed to test the question wording for the two main questions that would be used in the principal questionnaire. These two main questions would gather data from respondents in order to answer two of the main research questions of the thesis:

- What motivates people to upload their images to Flickr?
- What motivates people to tag their images in Flickr?

The pilot study also involved an additional research question 'are people seeking to make a commercial gain from the images they upload?' This question was included in light of an announcement that editors from Getty would be browsing Flickr with the intention of contacting users whose images they wished to use (Helft, 2008). This question was not central to the principal investigation.

5.1.2 Methods

In order to investigate what motivates people to upload and tag their images on Flickr, a pilot questionnaire was developed and administered on the web to a sample of Flickr users. Chapter 4 (research design) discusses the rationale behind the choice of a questionnaire as the research method for this thesis; the advantages and disadvantages of such an approach are also discussed as well as the rationale for the choice of an online questionnaire. Therefore the methods section of this pilot study chapter will focus on discussing the justification for the choice of survey software used, as well as the overall construction and design of the questionnaire.

5.1.2.1 Survey-authoring software

Survey-authoring software was used to both design and collect survey responses. Such software packages make online survey research much easier and faster (Wright, 2005). Until recently, creating and conducting online surveys was time consuming and often required familiarity with web authoring programs, HTML code and scripting programs (Wright, 2005).

Many online survey software packages and web survey services are currently available. The main differences between them are cost, the amount of questionnaire responses they allow to be stored within their system, and the functionality of the service in terms of the types of question formats permitted (e.g., multiple choice, drop down boxes, Likert scales, the use of skip-logic). The SurveyMonkey (www.surveymonkey.com) online survey and questionnaire tool was used for this research investigation as it offered the widest range of functions at the most reasonable price. At the time the initial account was set up with SurveyMonkey, the 'professional package' option was chosen. This allowed for: an unlimited number of questions to be included in the questionnaire; an unlimited number of

responses to be received; the ability to download responses into a spreadsheet; and full customisation of the questionnaire. Full customisation meant that there were no restrictions on the design, colour scheme or use of graphics that could be included in the questionnaire. Full customisation also meant that a unique URL could be created for the questionnaire, and separate 'collector pools' could be created for instances where the questionnaire had been administered to different samples.

5.1.2.2 Questionnaire design

As the target sample for the questionnaire was Flickr users, an online questionnaire was more appropriate than a paper based version since the only practical way of contacting users was online. The questionnaire was designed using the online survey software and questionnaire tool, surveymonkey.com. Utilising the SurveyMonkey software, a custom designed questionnaire could be created fairly quickly and assigned its own unique URL.

Research suggests that the testing of web questionnaires must focus on their visual aspects (Hansen & Couper, 2004 cited in, Presser et al., 2004) therefore the questionnaire was designed with a clean, simple and uncluttered layout. Also, as the appearance of a web based questionnaire can vary from respondent to respondent due to the use of different browsers, different user preferences and variations in hardware (Couper, 2000), a simple and uncluttered design would help to minimise potential problems arising from these issues. A distinctive colour scheme was used that was in keeping with the look and feel of the Flickr site, utilising the pink and blue logo colour pairing on a white background. A personalised logo was also designed to feature on the questionnaire that consisted of the white outline of two traditional luggage tags, one on a pink background and one on blue. Toepoel, Das, and Van Soest (2008) found that the more items that are placed on a screen, the more negatively a respondent views the layout. Scrolling and attention span are also important considerations for web pages; research by Nielsen (2010) found that long pages that require a lot of scrolling cause viewers to lose attention and become distracted, although scrolling is nonetheless preferable to having to click through different pages. Hence the questionnaire was kept as short as possible and consisted of only one page of questions with minimal scrolling needed. Too many questions may also result in a respondent losing interest or motivation during the course of completing the questionnaire.

5.1.2.3 Question construction, wording and order

The terminology that is used in the literature that looks at motivations for uploading images to Flickr is less well defined than the literature that looks at motivations to tag. Therefore the first question in the questionnaire asked respondents to briefly explain why they upload their images to Flickr, and respondents were given a free-text box in which to answer this question. This would allow for a rich qualitative insight into people's motivations, and it would also allow for any emergent motivations to be expressed. Whilst different users would be likely to use different terminology for their reasons, there would nonetheless be certain commonalities and answers could be grouped according to content analysis methodology.

Due to the fact that the literature that looks at motivation to tag has more defined terminology, specific question statements were designed to ask Flickr users about their motivations to tag. Trant (2008) asserts that the taxonomy provided by Ames and Naaman (2007) is a useful framework from which to study tagging motivation. Indeed, as shown in Table 2-2 in the literature review chapter, all motivations for image tagging can be grouped according to the 2 x 2 matrix put forward by Ames and Naaman (2007). Therefore this matrix was used as the basis for the construction of the questions relating to why users tag their images in Flickr. The first dimension of the matrix is *sociality* (relating to whether the tag's intended usage is for the individual or others i.e., self or social) and the second dimension is *function* (referring to a tag's intended use in either facilitating both later organisation and retrieval, or to communicate some additional context to viewers of the image).

The matrix results in four overarching motivations: self-organisation, self-communication, social-organisation, and social-communication. However, Oppenheim (1992, p. 159) advises that individual questions in a questionnaire should not measure more than one thing at a time. Therefore as the themes of the motivations overlap (i.e., self can relate to either self-organisation or self-communication), question items were developed that related to the singular constructs of self, social, organisation, and communication. This also meant that the questions would be less confusing and ambiguous, and would also allow for factor analysis to be performed. Factor analysis would determine how the singular constructs correlated with each other and establish if the four overarching motivations put forward by Ames and Naaman (2007) mapped in practice to Flickr users' motivations for tagging.

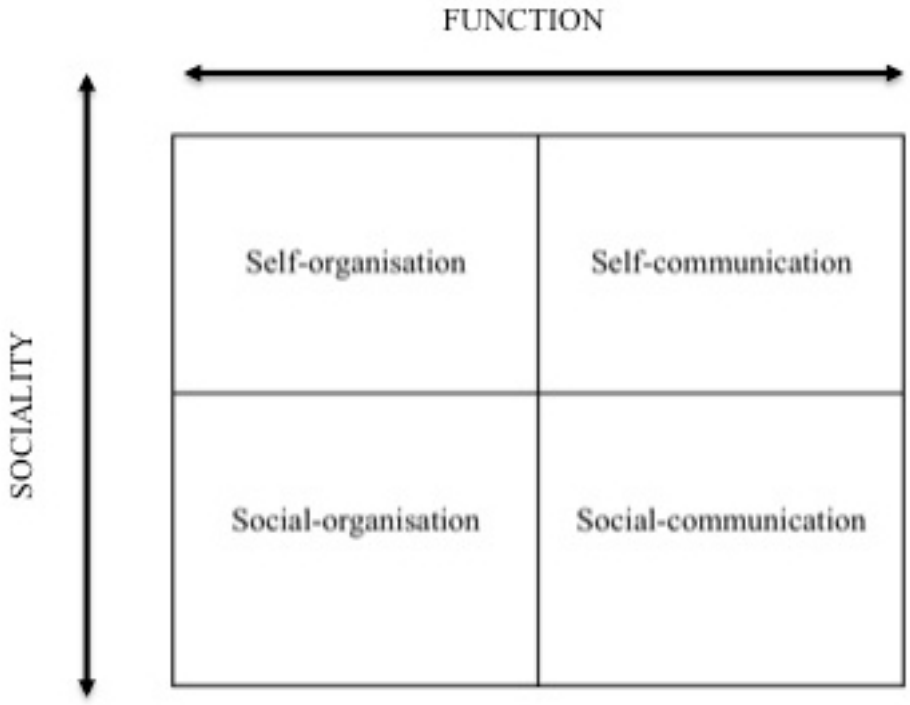


Figure 5-1 2 x 2 matrix of tagging motivation

Four questions were developed; one for each of the two main tagging motivations within each of the two dimensions, thus creating four main variables that tagging motivation could consist of (i.e., social, self, organisation, and communication).

Oppenheim (1992, p. 147) and Schwab (1999, p. 35) argue that a questionnaire should not rely on single questions when it comes to measuring the attitudes that are most important in the study. Therefore a reliability measure was added to the questionnaire and sets of questions were created for each of the four main tagging motivations, thus resulting in two questions per singular construct, and eight questions in total. Respondents should therefore answer similarly on the questions that were paired together. All motivation statements were worded in a short and concise manner in order to reduce ambiguity (see Table 5-1 for the question wording).

The questions were structured as statements, which respondents had to agree/disagree with using a 5-point Likert scale. The use of Likert scales is the most popular attitude scaling procedure (Oppenheim, 1992, p. 195) and is appropriate because respondents quickly identify with what is expected of them due to the well recognised layout of Likert scales.

Gillham (2007, p. 32) argues that 7-point scales are not necessary because respondents don't use the whole scale. A disadvantage of using Likert scales is central tendency bias (respondents avoid using the extreme response categories). This can usually be minimised via careful question wording to ensure that each end of the scale does not sound too extreme (Oppenheim, 1992, p. 233).

Table 5-1 Questionnaire items

SELF	SELF 1: SELF 2:	I tag my images for my own personal use. When I tag my images I do not think about how useful the tags will be to other people.
SOCIAL	SOCIAL 1: SOCIAL 2:	When I tag my images I try to use tags which will also be useful to other people. I use tags which will help other people to find my images.
ORGANISATION	ORG 1: ORG 2:	I tag my images in order to place them into categories. I tag my images in order to group them together around common themes (such as event, location, date)
COMMUNICATION	COMM 1: COMM 2:	I tag my images as a way of conveying information about the image I tag my images as a way of enhancing what is contained in the image

The pilot questionnaire was comprised of five main sections:

1. Introductory text at the top of the questionnaire that gave a brief outline of the purpose of the questionnaire, as well as advising respondents that their responses would be treated as confidential and that all published information would be anonymised.
2. A free-text box asking respondents to explain why they upload their images to Flickr. A free-text box was used so that respondents could express the full range of their reasons for using Flickr.
3. Motivation statements relating to respondents' reasons for tagging their images (using a 5-point Likert scale). The statements were presented in an arbitrary order so that the respondents were less likely to detect the pairs of statements that were essentially asking the same thing.
4. A question asking if respondents hoped that their images would be picked up by a commercial stock photography organisation or the media.
5. Demographic questions: age, gender, and nationality.

> Respondents were asked to give their exact age rather than being presented with age groupings that they had to pick from. Whilst some researchers prefer age groupings as age is often considered a sensitive subject, this was decided against for two reasons: exact ages allow for a richer insight and continuous descriptives (mean average etc); also, interval data can be converted into nominal or ordinal data if needed, but nominal and ordinal data can't be converted into interval data (Vaughan, 2009, p. 6).

The nationality question consisted of a drop down list of countries based on Flickr's list of countries for account creation. The drop down list also included an option for if the respondent preferred not to disclose their nationality. Contextual questions were not included in the pilot study (e.g., questions relating to how many groups a user is a member of, how many contacts they have, and what type of photographer they class themselves as).

Only the motivation to tag statements and the reason for uploading images to Flickr questions were compulsory; all of the demographic questions could be skipped, as people can be sensitive about disclosing information such as their age. However, as the issue of what motivated the respondents to upload and tag their images in Flickr was central to the investigation, it was essential that these questions could not be skipped, and so the questionnaire was set up so that an error message would pop up on screen if the respondent had missed one of these questions. The demographic questions were placed at the end of the questionnaire because the respondents might be more likely to disclose information such as their age once they had already answered some questions and felt a greater sense of involvement with the questionnaire as a whole.

As the main purpose of the pilot study was to find out if there were any problems with the questionnaire, a free-text box was inserted at the end of the questionnaire, asking respondents to indicate if any of the questions didn't make sense, if they felt anything was missing, or if they had any ideas or thoughts on how the questionnaire could be improved. See Figure 5-2 for the final pilot questionnaire.

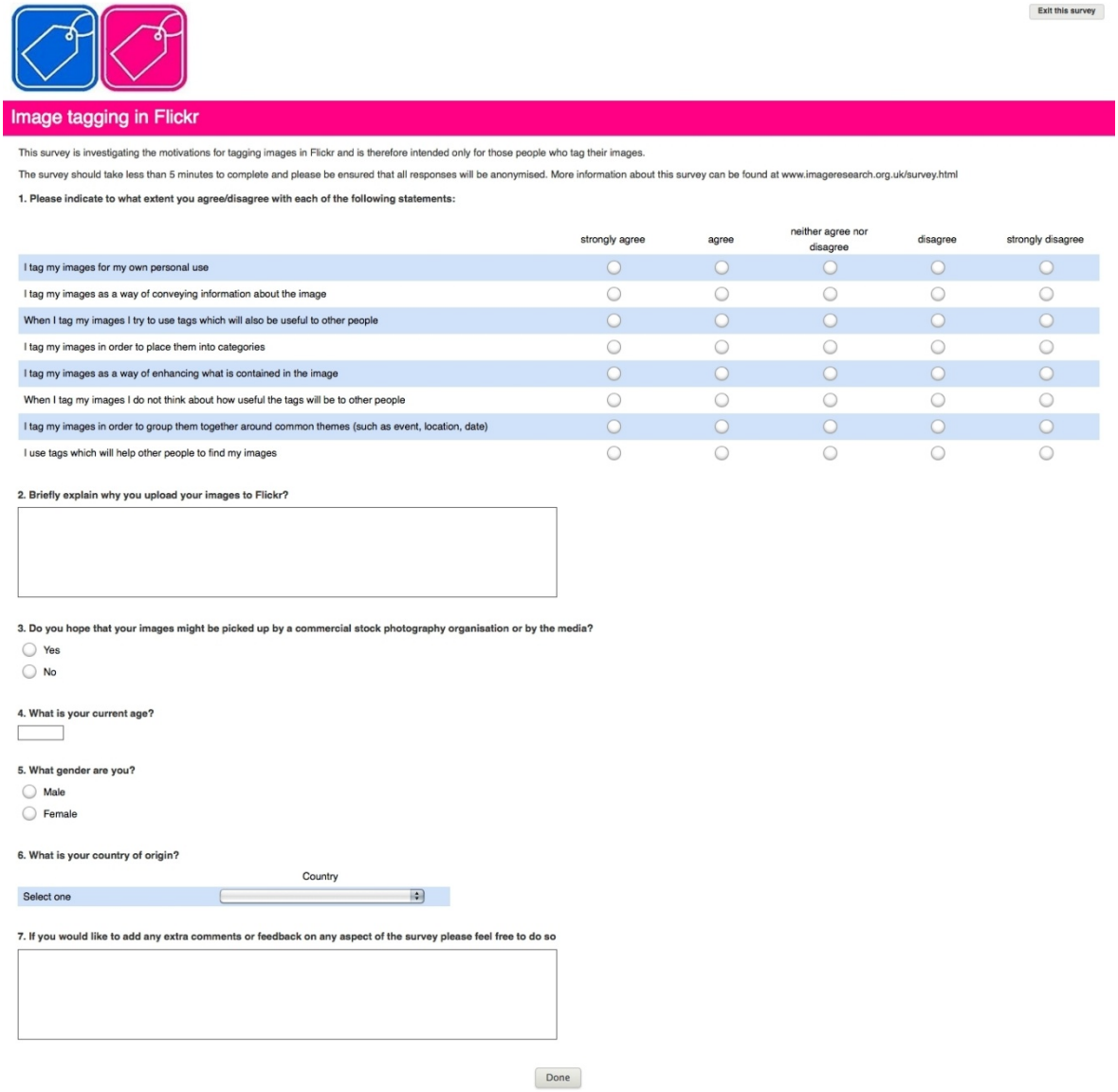
5.1.2.4 Data collection

In order to try to increase the response rate of the questionnaire, both a direct and an indirect method of data collection were utilised. For the direct approach, the URL of the questionnaire was posted to the discussion forums of two public Flickr groups (*Flickr Social* and *Surveys&Quizzes)*. These groups were chosen because they were not targeted to a specific demographic of users and they also had all encompassing policies regarding what could be posted to their discussion threads; the vast majority of groups on Flickr strongly discourage the posting of items that are not specifically related to the theme of the group, and the theme may also be strongly associated with a specific demographic of users, thus biasing the sample. However, even targeting Flickr groups that are all encompassing is still biasing the sample specifically to members of those groups. The indirect approach advertised the questionnaire URL on my Facebook and Twitter profiles, and also on my personal webpage. The indirect approach also created a slightly biased sample in favour of friends and known acquaintances who were likely to visit my Facebook, Twitter, and personal webpage. However the main purpose of the pilot study was to test the ease of use of the questionnaire, rather than to reach a representative sample of Flickr users.

In all instances, the questionnaire URL was accompanied by a small paragraph of explanatory text, briefly stating the purpose of the questionnaire and advising that all responses would remain confidential and any published results would be anonymised. A URL was also provided that linked to my webpage where further details on the questionnaire and the study as a whole could be found. The questionnaire was available for three weeks during March 2010.

5.1.3 Results

A total of 33 valid responses to the questionnaire were received. 51.5% of the respondents were female, and the mean average age of the respondent was 30 years old. The majority of the respondents originated from the UK and Denmark. See Figure 5-3 for a full breakdown of nationalities.



Exit this survey

Image tagging in Flickr

This survey is investigating the motivations for tagging images in Flickr and is therefore intended only for those people who tag their images.

The survey should take less than 5 minutes to complete and please be ensured that all responses will be anonymised. More information about this survey can be found at www.imageresearch.org.uk/survey.html

1. Please indicate to what extent you agree/disagree with each of the following statements:

	strongly agree	agree	neither agree nor disagree	disagree	strongly disagree
I tag my images for my own personal use	○	○	○	○	○
I tag my images as a way of conveying information about the image	○	○	○	○	○
When I tag my images I try to use tags which will also be useful to other people	○	○	○	○	○
I tag my images in order to place them into categories	○	○	○	○	○
I tag my images as a way of enhancing what is contained in the image	○	○	○	○	○
When I tag my images I do not think about how useful the tags will be to other people	○	○	○	○	○
I tag my images in order to group them together around common themes (such as event, location, date)	○	○	○	○	○
I use tags which will help other people to find my images	○	○	○	○	○

2. Briefly explain why you upload your images to Flickr?

3. Do you hope that your images might be picked up by a commercial stock photography organisation or by the media?

○ Yes
○ No

4. What is your current age?

5. What gender are you?

○ Male
○ Female

6. What is your country of origin?

Country

Select one

7. If you would like to add any extra comments or feedback on any aspect of the survey please feel free to do so

Done

Figure 5-2 Pilot study questionnaire

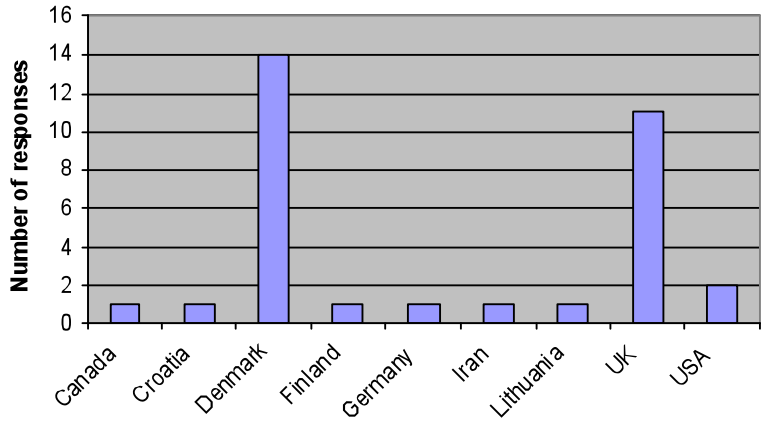


Figure 5-3 Respondent's country of origin

Why people upload their images to Flickr

Participants were asked to briefly explain why they upload their images to Flickr. The responses were broken down into the reasons stated and these reasons were grouped together according to the overarching motivational factors as put forward by Ames and Naaman (2007) (i.e., social-organisation, social-communication, self-organisation, self-communication). Whilst this followed a loose content analysis methodology, the main purpose of the pilot study was to test the coherence of the questionnaire as a whole and so a detailed content analysis was not performed at this stage (see section 6.1.2.1 of the principal methods and investigation chapter for a detailed justification and overview of the content analysis used in the principal investigation). Almost half of the respondents (48%) reported two main reasons behind their use of Flickr, with the two most predominant reasons being to share images with friends and family (social-organisation), and to promote their work and connect with other people in the photography community (social-communication).

Some example comments

Respondent 22: "I use Flickr to promote my creative work, get feedback, and share with friends/family." Respondent 31: "To keep a nicely presented, easily shared record of my photography and to get feedback, encouragement and advice from other users about technique."

45% of respondents reported that they had only one main motivation for using Flickr, and 6.5% reported that they had three main reasons. Figure 5-4 shows respondents' overall preferences between each of the four main motivational factors.

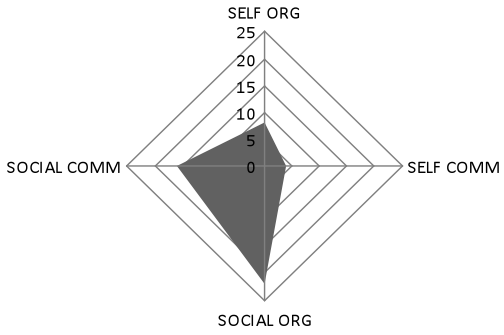


Figure 5-4 Number of respondents selecting each of the four motivational practices

The results support the general consensus that people are drawn to Flickr because of the social aspects and the 'community environment' it provides, rather than using it solely as a place to store and archive images.

Do people hope to make a commercial gain from their images?

Despite 51% of the respondents in this investigation specifically mentioning using Flickr as a way of promoting their work and receiving feedback on their images, 75.8% of respondents said that they did not use Flickr with the hope that their images would be picked up by either a commercial stock photography organisation or by the media. So whilst the 'sociality' element is a big factor for many Flickr users, people are predominantly interested in having their images found so that they can gain feedback and encouragement from other Flickr users, rather than hoping that their images will be picked up by a commercial agency or the media.

What motivates people to tag their images?

Motivations to tag images slightly differ from motivations to upload images to Flickr. Whereas people strongly state that social-organisation is the main factor in using Flickr, social-communication comes out slightly on top in terms of motivations for tagging images (see Figure 5-5). Social-organisation and social-communication are the top two motivational factors in both instances. This finding differs from the work of Ames and Naaman (2007) and Cox, Clough, and Marlow (2008) who found that social-organisation was the top motivating factor for tagging practices in Flickr.

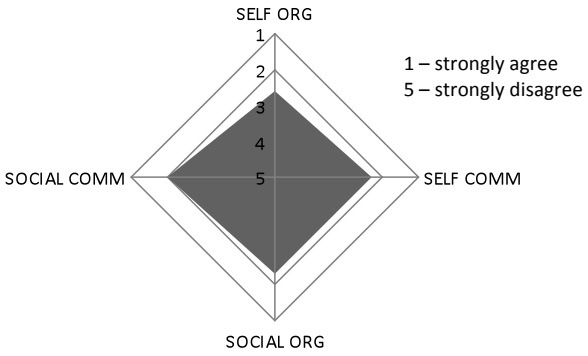


Figure 5-5 Motivations for tagging images

Whilst people seem to be primarily drawn to Flickr because of the social function and community environment that it provides, tagging practices don't necessarily follow this primary motivation, with self-organisation and self-communication reasons appearing as fairly high motivational factors overall. It seems that people are more motivated by the desire to either please themselves or others when it comes to describing and adding context to their images.

Using a Spearman correlation and a Mann-Whitney test there was found to be no evidence that age ($r_s = 0.170$, P = 0.345) or gender (U = 107, P = 0.267) had an influence on tagging motivation.

Reliability – Cronbach's alpha

With questionnaires, it is important that the questions included within a particular scale (or set of questions measuring a construct) are reliable (i.e., consistent). Reliability is defined as the extent to which a set of variables is consistent in what it is intended to measure (Hair et al., 2006, p. 137). This reliability is judged by analysing question responses to assess how highly they correlate with each other, and whilst it is expected that different respondents will have different opinions and hence answer questions differently, this should not be because the questions are confusing or ambiguous; there should be overall similarity in the range of answers for related items.

The eight motivational statements that were designed to test the elements of self, social, communication, and organisation were therefore tested for internal consistency using Cronbach's alpha split-half reliability in order to measure if responses from the same person correlated highly with each other. The eight statements consisted of four pairs of statements designed to measure the four underlying constructs of self, social, organisation and communication. The four pairs were treated as four separate scales consisting of two items each and the four scales were tested for their internal consistency. The alpha scores are presented in Table 5-2. Hair et al. (2009, p. 102) deem that the lower level of acceptability for alpha scores is .60, therefore the scales relating to self, social, communication, and organisation all have internal consistency and can be classed as reliable measures of the four singular constructs.

Table 5-2 Cronbach's alpha scores for the pilot questionnaire

	Cronbach's Alpha	No. of items
Construct of Self	0.658	2
Construct of Social	0.765	2
Construct of Organisation	0.688	2
Construct of Communication	0.615	2

Factor analysis

As well as a questionnaire being a consistent measurement of what it intends to measure, it is also important that a questionnaire has validity. Validity indicates 'the degree to which an instrument measures what it is supposed to measure' (Oppenheim, 1992, p. 160). The term given to this form of validity is construct validity, and it is arguably the most important form of validity (Bagozzi, Yi, & Phillips, 1991). Other types of validity include: content validity (the existence of a well balanced sample of items); concurrent validity (how well the test correlates with other tests that measure the same topic); and predictive validity (how well the test can forecast some future criterion) (Oppenheim, 1992, p. 162). Despite the small sample size, in order to investigate the construct validity of the pilot questionnaire, a factor analysis was performed on the survey items relating to the motivational constructs of self, social, organisation and communication. The correlation matrix (see Table 5-3) shows that people gave similar answers to the two survey statements relating to social motivations, suggesting that this was a particularly coherent construct.

Table 5-3 Pilot study factor analysis correlation matrix

		Self1	Self2	Social1	Social2	Comm1	Comm2	Org1	Org2
Correlation	Self1	1.000	.387	-.351	-.514	.253	.265	.168	-.026
	Self2	.387	1.000	-.821	-.654	.162	.044	.095	-.125
	Social1	-.351	-.821	1.000	.622	.037	.085	.043	.165
	Social2	-.514	-.654	.622	1.000	-.077	-.100	-.172	-.162
	Comm1	.253	.162	.037	-.077	1.000	.354	.100	.127
	Comm2	.265	.044	.085	-.100	.354	1.000	.169	.164
	Org1	.168	.095	.043	-.172	.100	.169	1.000	.418
	Org2	-.026	-.125	.165	-.162	.127	.164	.418	1.000

The 'social' and 'self' statements tended to pair up with each other, so that someone scoring high on one would tend to score low on the other. This means that in the pilot study sample there are three main types of motivation rather than the predicted four.

This finding is further corroborated by the results shown in Table 5-4. Factor 1 is a social factor – the two social factors load on it and the two self factors negatively load on it (so are strongly not associated with it). Factor 2 is an organizational factor. Factor 3 is a communication factor, with negative loading on the self-questions; suggesting social and self motivations are polar opposites in Flickr.

In summary, the factor analysis suggests that sociality (self vs. social), organization and communication factors are the three main motivations for tagging images.

Table 5-4 Pilot study rotated factor matrix

	Factor		
	1	2	3
Social1	.910		
Self2	-.869		
Social2	.765		
Self1	-.469		.438
Org2		.848	
Org1		.482	
Comm2			.610
Comm1			.541

5.1.4 Discussion

The results from this pilot investigation suggest that whilst it is possible to have a number of different motivations for using Flickr, motivation to tag will tend to be driven by only one direction of sociality (i.e., for oneself or for others) even if a person states that their motivation for using Flickr in the first place is for a mixture of self and social reasons. Tagging tends to be driven exclusively by either self or social reasons and suggests that tagging is very much directed by the specific image it is being assigned to, rather than as part of an overall tagging strategy. This does not mean however that the tags can't be

simultaneously useful in a number of different contexts, only that the image uploader is not motivated to tag for a number of different reasons.

The results give insights into why people upload and tag their images on Flickr, but the results cannot be generalised due to the small sample size. Whilst some literature suggests that it usually takes no more than 12-25 cases to reveal the major difficulties and weaknesses in pre-test questionnaires (Sheatsley, 1983) this is referring more to the design of the questionnaire and the discovery of things such as suppositions, awkward wordings or missing categories. In order to test the underlying assumptions of the information contained within the variables being questioned, it is suggested that, 'a minimum of five subjects per variable is required for factor analysis' (Coakes & Steed, 2001). This investigation was therefore seven subjects short of the 40 required in order to fully test the eight statements included in the factor analysis and therefore a detailed explanation of the factor analysis is not provided. There were also sampling biases that mean the results are not robust. However the results from the factor analysis were clear in suggesting that there were three main factors that made up the motivational statements rather than the predicted four. This could be tested using a larger sample.

Despite the heavy bias towards UK and Danish participants, no noticeable differences were found in the motivational intentions of these two nationalities, so the main factor is the European bias, which could be further investigated by having a larger sample from a more internationally representative set of countries.

As with all surveys there is the possibility that participants may have lied when answering questions. People often answer questions in the way that they think they are expected to answer, and people also often answer questions quickly, without giving much thought to their answers. In order to try to overcome this problem, the main motivational questions were asked twice, to test whether respondents answered similarly on the pairs of questions.

As stated in the Results section of this pilot study, it is possible for someone to have more than one main motivation to use Flickr, as well as more than one main motivation for tagging their images. However, whilst motivations to use Flickr can be for a mixture of both self and social reasons (i.e., using Flickr as a personal archive as well as using it to share images with friends and family), tagging motivations were found to be exclusively

for either self or social reasons. This is particularly interesting given that a number of participants in this investigation specifically stated both self and social reasons for using Flickr:

Some example comments

Respondent 17: "I use Flickr to archive for myself and also to promote my work." Respondent 25: "to store my images and to share with friends." Respondent 30: "as storage and for displaying my images to friends and family."

None of the respondents in the pilot study gave any feedback stating that they found any of the question wordings ambiguous or difficult to understand, and no one had any suggestions on how the questionnaire could be improved. This therefore suggested that the question wording for the two main questions within the questionnaire would not need to be revised for use in the principal questionnaire.

5.1.5 Conclusion

Whilst motivations for using Flickr and uploading images can be for a number of different reasons at the same time, motivations for tagging images tend to be more narrowly focussed. Users may employ Flickr as both a personal archive and as a place to share images with friends and family, but their reasons behind choice of tags will tend to be very distinctly either a 'self' or a 'social' action. Taggers don't appear to want to use a mixture of highly personal and social tags; they claim to adopt one strategy or the other, regardless of whether they are tagging for archive and storage, or communicative purposes.

In support of much of the previous work carried out on Flickr, the respondents who took part in this investigation seem to use Flickr for the social aspects and the community environment which it provides with social-organisation and social-communication being the two most popular motivational factors overall. Despite users desires to have their images found and commented upon, as a general rule, they don't seem to be interested in making a commercial gain from the images they upload – the community spirit of Flickr and its ability to connect people both known and unknown to the image uploader seems to be its most appealing feature. However the data set from this pilot study is too small to be able to draw any firm conclusions.

Whilst the findings from the pilot study were used to inform the principal investigation, they do not contribute to the overall findings or conclusions of the thesis.

6 Principal methods and investigation

6.1 Introduction

The research design chapter discussed a range of approaches for achieving the research aim and objectives of this thesis investigation, before justifying the choice of a survey approach, utilising questionnaire and automatic data collection methods. This chapter addresses specifically how the data for the principal investigation will be collected and analysed in order to meet these objectives.

The main objectives are as follows:

1. To identify what motivates users to upload their digital images to Flickr
2. To identify what motivates users to tag their images in Flickr
3. To identify how users tag their images in Flickr
4. To identify what effect motivation to upload and tag has on the types of tags users assign to their images in Flickr

In order to achieve these objectives, a secondary set of method objectives were developed:

Table 6-1 Method objectives

Method objective		To meet main objective no.
A	Design and administer a questionnaire to establish users' motivations for uploading and tagging images in Flickr	1 & 2
B	Develop a content analysis scheme for classifying users' motivations for using Flickr	1
C	Collect images, their accompanying tags, and additional account information from Flickr users	3
D	Develop a classification scheme for analysing the types of tags users assign to their images	3
E	Compare users' claimed motivations for uploading and tagging their images against the types of tags they use	4

6.1.1 Method objectives A & C

The survey approach involved the use of a semi-structured questionnaire designed to ask Flickr users about their motivations for uploading and tagging their images (method

objective A). The automatic data collection method would facilitate both the selection of the sample population to be surveyed via the use of the Flickr API, as well as being the method for obtaining users' image, tag and additional Flickr account data (method objective C).

6.1.1.1 Questionnaire modifications

The semi-structured questionnaire was designed and tested as part of the pilot study and chapter 5 rationalises the questionnaire design, construction and wording. The pilot study was intended to test the two core questions in the questionnaire (i.e., what motivates users to upload their images to Flickr, and motivates users to tag their images in Flickr), therefore some of the contextual questions were not included in the pilot study (e.g., questions relating to how many groups a user is a member of, how many contacts they have, and what type of photographer they class themselves as). The pilot study was also used to form the basis of a conference publication (Angus & Thelwall, 2010), and so the question relating to whether or not users hope to make a commercial gain from their images that had been included in the pilot study version of the questionnaire was not needed for the principal investigation.

Based on these factors, along with the feedback and results from the pilot study, a number of modifications were made to the questionnaire prior to its use in the main study.

The following questions were added:

- How many groups are you a member of in Flickr?
- How many contacts do you have in Flickr?
- What type of photographer are you?
  (a casual snapshooter / a serious amateur / a professional - does photography provide your main source of income?)

Whilst it is possible to retrieve data such as how many groups a user is a member of from the Flickr API, only the public groups that a user is a member of would be listed, so this was a question best suited to the questionnaire. A user may be a member of a number of private groups, and whilst they would not perhaps want to disclose what those groups were, it seems likely they would be comfortable giving a figure of how many groups. This

is also true for the inclusion of the question asking how many contacts a user has, as again, the Flickr API will only give data on the number of public contacts. As Flickr users do not have to specify on their accounts what kind of photographer they are, this was information that could only be discovered via the inclusion of the question in the questionnaire.

As part of the research sub-questions that were developed (outlined in section 4.2 of the research design chapter) the following information was also required for the principal investigation:

- How many public photos a user has
- Whether or not they have a Pro account

This information could be easily collected via the use of the Flickr API, and collecting it this way would also help to prevent the questionnaire from becoming too cluttered. It was therefore necessary to insert a text box into the questionnaire asking for respondents to enter their Flickr screen names, and also a tick box for the respondents to indicate if they were happy for their image and tag data to be compared against their answers to the questionnaire. Users were asked for their Flickr screen names rather than their unique NSID identifier as asking for this might have caused confusion due to the fact it is not overly apparent where to find out what your NSID identifier is and providing lots of instructions to find it would have both compromised the simplicity of the questionnaire design, and also have potentially discouraged users from participating. However the screen name and NSID number are both linked therefore by having one it is easy to find out the other. Whilst data about Flickr users and their online behaviour is publicly available from the Flickr API, explicit permission was needed from users in this case due to the fact their online data was to be compared against their answers to the questionnaire.

There is often a lack of cooperation amongst online communities when it comes to being asked to invest personal time into completing a task such as filling out a questionnaire (Kollock, 1999), and monetary incentives are often important in enticing people to participate (Raban & Harper, 2008). Six prizes were therefore offered as incentives to fill out the questionnaire. The addition of the text box asking for respondents' screen names doubled up as a way of being able to identify Flickr users in order to enter them into a random draw for a chance of winning one of the prizes. Five prizes were offered to everyone who completed the questionnaire, and the extra sixth prize was offered to

everyone who ticked the check box allowing for their online data to be compared with their questionnaire results. Offering a gift incentive increased the likelihood of respondents trying to complete the questionnaire more than once in order to increase their chances of winning (Konstan et al., 2005), however the SurveyMonkey software included the facility of allowing only one response per IP address, and although this was not a fool-proof method as obviously respondents could use different computers to complete the questionnaire, it was nonetheless a measure to minimise this risk. The fact that respondents also had to give their Flickr screen name in order for them to be contacted if they won one of the prizes also acted as a safeguard against multiple responses from the same person, as duplicate screen names could be easily spotted once compiled together in a spreadsheet. It was also unlikely that a user would have more than one Flickr account, and thus a different 'identity' with which to complete the questionnaire.

The factor analysis that was performed on the pilot questionnaire revealed that people gave similar answers to the survey statements relating to social motivations, suggesting that this was a coherent construct. However, the 'social' and 'self' statements were found to pair up with each other, so that someone scoring high on one tended to score low on the other, suggesting that social and self motivations are polar opposites in Flickr. This indicated that there were three main types of independent motivation, rather than the proposed four. However, whereas it usually takes no more than 12-25 cases to reveal the major difficulties and weaknesses in a pre-test questionnaire (Presser et al., 2004), this is referring more to the design of the questionnaire and the discovery of things such as suppositions, awkward wordings or missing categories. In order to test the underlying assumptions of the information contained within the variables being questioned, it is suggested that, 'a minimum of five subjects per variable is required for factor analysis' (Coakes & Steed, 2001). The pilot study was therefore seven subjects short of the 40 required in order to fully test the eight statements in the Likert scale that attempted to measure motivation. In light of this, the motivation statements included in the pilot study were not be altered for their use in the principal study, in order to investigate if the same results would be found from testing a larger and more representative sample.

Flickr users do not have to specify their nationality or the country they are based in when they create an account, nor do they have to disclose their gender or age, so these questions

were all kept in the questionnaire and kept in the same format as they had been in the pilot study.

The question in the pilot study that had asked respondents if they hoped that their images might be picked up by a commercial stock photography organisation or by the media was deleted as this was an extraneous question and only relevant to the aims and objectives of the pilot study. Likewise, the free-text box that had asked respondents to add any comments or feedback on the survey was also deleted as this question was for the purposes of the pilot study.

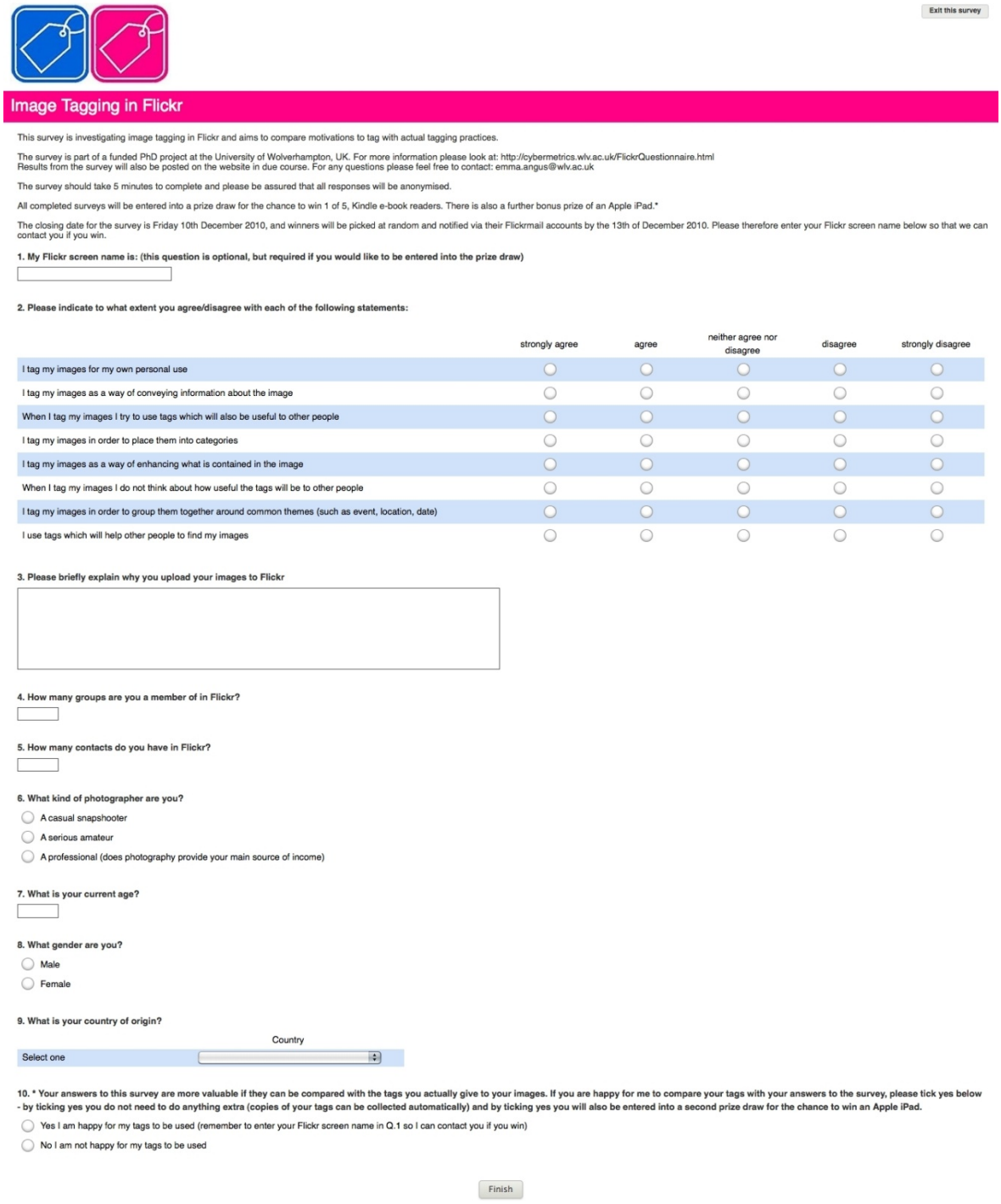
The questionnaire kept the same overall design outlined in the pilot study chapter, however the changes that were made necessitated the altering of the introductory text that accompanied the questionnaire (See Figure 6-1). This text included the assurance that all responses would be anonymised. However, introductory text should not be too long, so it was kept as short and as succinct as possible, and a further URL link was provided, which the respondent could follow if they wished to find out about the study in more detail. The URL linked to a page set up on the Statistical Cybermetrics Research Group website (see Figure 6-2), which gave more in-depth detail into the research project. Linking to a page that had been set up on the research group's website, and thus affiliated with the University of Wolverhampton should provide extra assurance to potential respondents that the questionnaire was credible and not spam.

The final questionnaire and accompanying text from the research group's website were submitted to the University Ethics Committee for review and full clearance was granted for their use in October 2010. This assurance of ethical clearance was also then added to the information on the research group's website to give further credibility to the questionnaire.

6.1.1.2 Principal questionnaire

The pilot study questionnaire tested the layout, order, and question wording on a real sample of users. The results from the pilot study highlighted the areas of the questionnaire that needed revising slightly. These revisions were implemented, ready for the questionnaire to be used in the principal investigation. See Figure 6-1 for the final version

of the questionnaire and Figure 6-2 for the accompanying information on the research group website.



Exit this survey

Image Tagging in Flickr

This survey is investigating image tagging in Flickr and aims to compare motivations to tag with actual tagging practices.

The survey is part of a funded PhD project at the University of Wolverhampton, UK. For more information please look at: http://cybermetrics.wlv.ac.uk/FlickrQuestionnaire.html
Results from the survey will also be posted on the website in due course. For any questions please feel free to contact: emma.angus@wlv.ac.uk

The survey should take 5 minutes to complete and please be assured that all responses will be anonymised.

All completed surveys will be entered into a prize draw for the chance to win 1 of 5, Kindle e-book readers. There is also a further bonus prize of an Apple iPad.*

The closing date for the survey is Friday 10th December 2010, and winners will be picked at random and notified via their Flickrmail accounts by the 13th of December 2010. Please therefore enter your Flickr screen name below so that we can contact you if you win.

1. My Flickr screen name is: (this question is optional, but required if you would like to be entered into the prize draw)

2. Please indicate to what extent you agree/disagree with each of the following statements:

	strongly agree	agree	neither agree nor disagree	disagree	strongly disagree
I tag my images for my own personal use	○	○	○	○	○
I tag my images as a way of conveying information about the image	○	○	○	○	○
When I tag my images I try to use tags which will also be useful to other people	○	○	○	○	○
I tag my images in order to place them into categories	○	○	○	○	○
I tag my images as a way of enhancing what is contained in the image	○	○	○	○	○
When I tag my images I do not think about how useful the tags will be to other people	○	○	○	○	○
I tag my images in order to group them together around common themes (such as event, location, date)	○	○	○	○	○
I use tags which will help other people to find my images	○	○	○	○	○

3. Please briefly explain why you upload your images to Flickr

4. How many groups are you a member of in Flickr?

5. How many contacts do you have in Flickr?

6. What kind of photographer are you?

- ○ A casual snapshooter
- ○ A serious amateur
- ○ A professional (does photography provide your main source of income)

7. What is your current age?

8. What gender are you?

- ○ Male
- ○ Female

9. What is your country of origin?

Country

Select one

10. * Your answers to this survey are more valuable if they can be compared with the tags you actually give to your images. If you are happy for me to compare your tags with your answers to the survey, please tick yes below - by ticking yes you do not need to do anything extra (copies of your tags can be collected automatically) and by ticking yes you will also be entered into a second prize draw for the chance to win an Apple iPad.

- ○ Yes I am happy for my tags to be used (remember to enter your Flickr screen name in Q.1 so I can contact you if you win)
- ○ No I am not happy for my tags to be used

Finish

Figure 6-1 Final version of the online questionnaire used in the principal investigation into what motivates users to upload and tag their images on Flickr

Despite the international user base of Flickr, only an English language version was produced and administered. The reason for this decision was threefold: firstly, research by (Yan, 2007 cited in Cox, 2008) found that 88% of Flickr users were from America or Europe, and whilst there are many different European languages, English is widely understood; secondly, translating questions generates errors due to inexact translations, making it problematic to attempt on a large scale; and thirdly, due to the findings of Dotan and Zaphiris (2010) who found that there is evidence to suggest that different nationalities tend to tag in English, suggesting that English is widely used by Flickr members.

6.1.1.3 Sample and data collection

6.1.1.3.1 Random probability sample

In order to minimise sample bias and reach a representative sample of Flickr users a genuinely random probability sample from the full population of Flickr users was selected and sent the questionnaire URL. Random samples are the ideal sampling method for research as each member of the population in question has an equal and independent chance of being selected (Vaughan, 2009, p. 67). Unsolicited questionnaires sent to the general public tend to have a 1-20% response rate (Ray, 2008). Nov, Naaman and Ye (2009a) sent a web-survey to a random sample of 2740 Flickr users who had at least one publicly viewable photo and they received 422 valid responses (15.4% response rate). It seemed reasonable to therefore assume a 10% response rate for this investigation as although the questionnaire was unsolicited, it was being sent to a narrowly focussed sample of the 'general public' and was adopting a similar approach to the work of Nov, Naaman and Ye (2009a). A minimum of 300 Flickr users was needed to be able to generalise from. At least 3,000 Flickr users therefore needed to be contacted in the first instance in order to result in a minimum sample of 300 respondents based on the assumed 10% response rate to questionnaires.

A random sample of 3759 users was retrieved using a bespoke Python program that interacted with the Flickr API. Each Flickr user has their own unique identifier, called an NSID, which is assigned to them when they create their accounts. The identifier consists of a string of eight numbers followed by @N and two final numbers (Bausch & Bumgardner, 2006, p. 219).

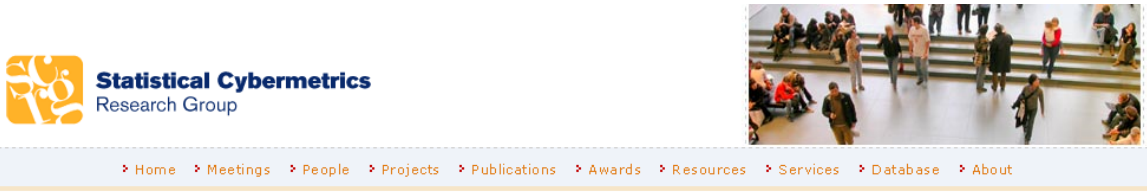


Figure 6-2 Additional information to accompany the online questionnaire into what motivates users to upload and tag their images on Flickr

The Python program acted as a random number generator and created potential NSID strings, and utilising the **Get.user.profile** call method from the Flickr API it checked to see if the string it had generated was a valid NSID. If the string was a valid NSID it saved the URL for the profile page of the user in a text file alongside the NSID identifier. This

random method meant that the sample of users was not biased in favour of people who had recently joined Flickr, or people who had uploaded lots of images, and it was also not biased in terms of demographic information.

The Flickr guidelines on the use of their API were not clear regarding how many queries they are happy for someone to run within a particular time period, but a time delay was factored into the Python program so that queries were sent to Flickr at timed intervals to reduce the risk that the program interfered with Flickr's servers. In addition to this, the program was also limited to only being run early in the morning. This was because Flickr is American, and early in the morning in the UK is during the night in the USA, and therefore the collection was less likely to disrupt the Flickr servers. Koster (1993) advocates running programmes at 'opportune times' in order to minimise the amount of disruption caused to the host server.

Due to the restrictions on the time of day the program was run and also due to the timed intervals that the queries were sent to Flickr, it took a period of four weeks starting from mid September 2010 in order to collect the sample of 3759 Flickr users.

Whilst the random sample of users was being collected, the process of sending questionnaire URLs to the random users that had been identified up to that point was begun. The questionnaire link was sent via Flickr's Flickrmail service; Flickr were first of all contacted via email to check if they were happy for the Flickrmail service to be used in this way. They advised that this was fine, but that Flickr users could potentially view such unsolicited messages as spam. Flickr is very careful to prevent users or automated systems from spamming the Flickrmail facility and thus using it to reach large amounts of users for the purposes of spam messages; Flickr therefore limits the amount of Flickrmails that can be sent by any given user in any one day to 250. This restriction meant that the process of sending the surveys had to be started whilst random NSIDs were still being collected.

After a few days of sending out the questionnaire URL it became clear that the minimum desired response rate was not likely to be met as very few questionnaires had been completed. It was therefore necessary to modify the sample selection method to ensure that a minimum sample of 300 users could be achieved.

In order to try to find out why there was such a low response rate to the questionnaires that had been sent out to the initial sample of Flickr users, a second Python programme was created which interacted with the Flickr API in order to find out the last image upload date of the Flickr users that had been sent the questionnaire. From the results, the vast majority (66.5%) of the Flickr NSIDs were either inactive (i.e., their accounts had been created but had never had any photos uploaded to them) or the accounts did not have any publicly available photos. This finding was even more pronounced than the work of Prieur et al. (2008) who found that 39% of registered Flickr users seem to have inactive accounts (i.e., have no images uploaded and don't make use of any of Flickr's functionalities). However, in this case it was impossible to know if the accounts were inactive or just private. Whilst it was not ideal to rule out sending the survey to people who potentially just kept their images private (after all, this could be their main motivating factor for using Flickr) it was nonetheless decided that continuing to send questionnaire links to such a large proportion of 'possibly' inactive accounts could not produce a large enough sample.

Two additional samples of Flickr users were therefore targeted:

1. Flickr users who had uploaded at least one image at some point within the year 2010.
2. A snowball sample (utilising the social media platform of Twitter).

6.1.1.3.2 Flickr users who had uploaded at least one image in 2010

It could be argued that targeting Flickr users who had been active within the last year biased the sample, for instance in favour of new Flickr users who may not have very many images/tags uploaded to the system, or it could have biased it in favour of people who were active and social on Flickr. Nonetheless, filtering of this kind was necessary in order to try to increase the response rate, and the sample was still random, apart from the restriction that the users had uploaded within the last year.

Only 10% of any given sample of random Flickr users being retrieved had uploaded an image within the year 2010, therefore due to the time constraint of the survey deadline which had been set for December 2010, and also due to the restriction of only being able to send 250 Flickrmails per day, the rate at which random Flickr user NSIDs were being retrieved had to be increased. Over a period of two weeks during November 2010 the Python program was run concurrently on 4-10 different computers in the computer labs at

the University of Wolverhampton between the hours of 9am-9pm. Whilst this increase in the amount of requests that were concurrently being sent to Flickr could have put a strain on their servers, the bulk of these requests were still being sent out of office hours in the USA and were therefore unlikely to be causing problems.

Over the period of two weeks the program was run 303 times, retrieving a sample of 5,882 Flickr users who had uploaded images within the last year. From this sample of 5,882 users, an additional 5,500 questionnaire URLs were sent out.

6.1.1.3.3 Snowball sample

At the same time as filtering the random Flickr NSIDs to users that had uploaded within the year 2010, a third strategy was used in order to gain responses to the questionnaire, in case the filtered sample of Flickr users also did not have a high enough response rate. Using the micro-blogging website Twitter, the questionnaire URL was tweeted to my pool of followers (at the time the URL was tweeted I had 81 followers). I also asked a selection of large organisations with a presence on Twitter to tweet the URL, thus exposing it to much larger pools of followers. The organisations that tweeted the URL were of a research, technology, or photography orientation: LISResearch, I3A_Updates, fuelphotography and DailyDigi. Each of the three subsamples of potential Flickr users (totally random, those who had uploaded in 2010, and Twitter) were given a different questionnaire URL and thus it was possible to separate the responses into three different samples.

6.1.1.4 Questionnaire response rate

After a period of 12 days, 3,000 people from the initial random sample of 3,759 Flickr users had been sent the questionnaire link, and only 22 responses had been received (0.73 response rate). It was therefore clear that a large enough sample of data was not likely to be obtained from sending the questionnaire to random users in this way, and it was estimated that in order to obtain the desired target of 300 responses, 36,000 Flickr users would need to be sent the questionnaire link. Given that the sending of Flickrmails was limited to 250 per day, it became clear that this was not a viable option.

In addition to the random sample, two further samples of Flickr users were therefore targeted ('2010 users' and 'Twitter users' - as detailed in section 6.2.1.1.1 of the principal methods and investigation chapter).

This change in approach resulted in a total sample size of 459 responses. In using Twitter as a vehicle to obtain questionnaire responses, it becomes impossible to estimate the overall response rate to the questionnaire as it is impossible to know how many Twitter users will have seen a particular tweet, and also, having a tweet re-tweeted by another user adds a further level of complexity in estimating the potential number of people who are likely to have seen the tweet. However, the approach on Twitter yielded 125 responses. The response rates for both the random and 2010 samples were extremely low (Random sample: 22 responses from 3,000 questionnaires sent out = 0.73% response rate / 2010 sample: 312 responses from 5,500 questionnaires sent out = 5.67% response rate). However, the desired target sample size of a minimum of 300 responses was nonetheless achieved (and surpassed) despite the low overall response rate.

6.1.1.5 Cleaning the data

Before any analysis on the questionnaire responses could take place, it was first of all necessary to establish that all of the responses were valid. All of the responses were downloaded to an Excel spreadsheet and they were scanned for any missing data or invalid responses. Respondents were allowed to skip some of the questions in the questionnaire, and therefore there were a number of missing responses for some of the questions, however these will be discussed more specifically at the appropriate sections of the results chapter. Other than instances where certain questions had been skipped, all of the data that respondents had submitted appeared to be valid (i.e., no one claimed to be an erroneous age, such as 2 years old, or 202 years old etc.). However, in scanning through the Flickr screen names that respondents had entered, it was discovered that two respondents had completed the questionnaire twice, using the same Flickr screen name each time, and giving the same set of answers each time. The second set of answers in each case was therefore deleted.

As discussed in section 6.2.1.3, in order to be able to retrieve extra user information from the respondents who completed the questionnaire (i.e., whether they have a pro account,

how many public images they have, and their tag data) it was first of all necessary to convert their Flickr screen names into the unique NSID numbers linked to their account. This was achieved via the following API call method: **flickr.people.findByUsername.** Whilst the additional information was only collected from those respondents who had expressed that they were happy for this to take place, the NSID numbers were nonetheless collected for all of the respondents who had completed a questionnaire. This was so that any further duplicate answers could be detected (i.e., someone may have completed the questionnaire and then changed their Flickr screen name so that they could complete the questionnaire a second time, in which case although their screen name would be different, their NSID identifier would remain the same). In doing this, a third duplicate set of answers was found from someone who had used two different Flickr screen names linked to the same NSID identifier and who had completed both versions of the questionnaire in exactly the same way each time. The second set of answers was therefore deleted for this respondent. 24 respondents did not give their screen name, and therefore it was impossible to retrieve their NSID identifier or determine whether anyone from this pool of 24 respondents had completed the questionnaire twice. Whilst the survey authoring software recorded the ISP addresses for all of the questionnaire responses, this still does not guarantee that the same person has not completed the questionnaire twice. However, there seems little benefit to the respondent in doing this if it means that they can't be entered into the questionnaire prize draw due to the fact they have not submitted their screen name. Therefore all 24 of these responses were retained in the descriptive statistics section of the analysis.

In cleaning the data, a total of three sets of questionnaire answers were removed from the data set, leaving a sample of 456 valid responses.

6.1.1.6 Automatic data collection from Flickr

As stated in section 6.1.1.1, a tick box was added into the questionnaire asking respondents if they were happy for their tag data to be analysed alongside the answers they gave. The respondents were also asked to give their Flickr screen names and this provided a mechanism for account data to be accessed for all of the respondents who gave their consent.

As mentioned in the questionnaire modification section (6.1.1.1), additional information was also required from Flickr:

- How many publicly available photos the user has
- Whether or not the user has a pro account

In order to provide user information, the API needs to know the NSID number of the user(s) in question. Having asked questionnaire respondents to provide their Flickr screen names if they were happy for their online data to be investigated, it was first of all necessary to convert the list of screen names into the unique NSID numbers linked to them. This was achieved via the following call method: **flickr.people.findByUsername**

Having converted the usernames to a list of NSID numbers, the remaining information was collected from the API using the following call methods:

- How many photos a user has
  flickr.people.getInfo
- Whether or not the user has a pro account
  flickr.people.getInfo
- Utilising the user's Flickr screen name, a sample of their tag and image data could be collected using the following combination of call methods:
  methodflickr.people.getPhotos
  flickr.tags.getListPhoto

It is acknowledged in the literature that a person's tagging motivation and behaviour can change over time (Golder & Huberman, 2006). As the questionnaire in this investigation was asking people about their current motivation and tagging behaviour, it was crucial that the images and tags collected for each user would relate to their current practices, rather than being associated with images which may have been uploaded a number of years ago when a user's motivation may have been different to what it is now. Therefore for each user 10 of their most recent images were collected (or as many as were available if they did not have 10) and five random tags for each of the user's 10 images were also collected (or as many as were available if five had not been assigned).

6.1.2 Method objective B

The questionnaire included a free-text box asking respondents to describe why they upload their images to Flickr. This free-text box allowed respondents to answer this question in as many words as they wanted (this was the only free-text answer box in the questionnaire). Due to the qualitative nature of free-text it was necessary to develop a content analysis scheme in order to quantitatively code the responses given.

6.1.2.1 Content analysis (users' motivations for using Flickr)

Content analysis is a research technique for making replicable and valid inferences from texts concerning the contexts of their use (Krippendorff, 2004, p. 18). Content analysis has been used in previous research on Flickr that investigated the relationship between images and their accompanying tags (Rorissa, 2010) and also in determining types of photographers in Flickr (Cox, 2008).

The content analysis scheme was a bespoke scheme based on the methodology of Krippendorff (2004); a priori coding was used: the categories were established prior to the analysis based on various motivations identified in the literature, and additional motivations could be added to the scheme if they emerged from the responses given. The categories that were established prior to the analysis were based on the motivations put forward by Van House et al. (2004); Kindberg et al. (2005a, 2005b); Van House et al. (2005); Cox, Clough, and Marlow (2008); Nov, Naaman and Ye (2008) and Ames et al. (2010).

Whilst the studies listed above cover different aspects of motivation (e.g., motivation for taking photographs, motivation for using cameraphones, motivation for using Flickr), Van House et al. (2004) illustrate how 'different actions can satisfy the same motives, and as technology changes, so does the set of actions available to users'. This point is particularly pertinent in light of the emergence of cameraphone images – whilst the technology has changed, there may be a set of basic underlying motivations for taking pictures on a cameraphone and uploading images online that will be similar to the motivations for someone taking images on a digital SLR and uploading the images online. Although a set of new motivations may also have emerged, there may be core motivations that can be explained using studies of older technologies.

The main differences in the research that was used to inform the content analysis scheme are outlined below in Table 6-2.

Table 6-2 Overview of research included in the development of the content analysis scheme

Authors	Research focus	Motivations proposed
Van House et al. (2004)	Investigates the social uses of all photography	1. Constructing personal & group memory 2. Creating & maintaining social relationships 3. Self-expression & self-presentation
Kindberg et al. (2005a)	Investigates how people use cameraphones	Social or individual, and affective or functional
Van House et al. (2005)	Investigates why people use cameraphones	1. Personal & group memory 2. Creating & maintaining social relationships 3. Self-expression 4. Self-presentation 5. Functional (self & others) (relates to Kindberg)
Kindberg et al. (2005b)	Investigates why people use cameraphones	As Kindberg et al. (2005a) above
Cox, Clough, and Marlow (2008)	User behaviour in Flickr	Social signalling and community
Nov, Naaman and Ye (2008)	Investigates motivation on Flickr	Organisation or communication, for oneself, friends & family or the public / social signalling, attention / inspiration & enjoyment
Ames et al. (2010)	New developments in cameraphone photography	Search and retrieval directory

The work of Ames and Naaman (2007) (discussed in section 2.4.3 of the literature review chapter) explicitly investigates tagging motivations for images in systems such as Flickr, and whilst they discuss a range of different reasons for tagging, they propose four overarching motivations (i.e., self-communication, self-organisation, social-communication, social-organisation) and all of the motivations for tagging can be slotted into one of these four overarching categories. A lot of the literature that looks at motivation for taking photographs, as well as motivations for using cameraphones and using a system such as Flickr, rationalises the motivations using similar underlying reasons as that of Ames and Naaman's (2007) motivations to tag, and therefore the four overarching motivation categories proposed by Ames and Naaman (2007) seem appropriate descriptors for grouping together the individual motivations for uploading images to Flickr. Therefore the content analysis scheme used in this investigation uses the four overarching motivational constructs proposed by Ames and Naaman (2007) in order to group together the motivations outlined in Table 6-2. See Figure 6-3 for the final content analysis scheme.

6.1.2.1.1 Reliability – Krippendorff's alpha

A second classifier was used to classify 10% of the final sample in order to test the reliability of the content analysis procedure.

SOCIALITY		FUNCTION: Organisation	FUNCTION: Communication
	Self	**A) Search and retrieval directory** Use Flickr as a place to store and organise photos, either for long-term archive or as an online storage space which can be easily accessed at any time regardless of what computer the user is at. Typically expressed with terms such as: storage; archive; repository; organise; backup; high-resolution; access; anywhere.	**B1) Memory / personal reflection** Use Flickr as a way of being able to keep track of and document or record day to day experiences/life events/holidays/family gatherings etc for oneself rather than with the intent to share with others OR to keep track of progress on a project or in documenting one's own development in learning how to become a better photographer. Typically expressed with terms such as: memory; keeping-track; photo-journal; diary; document; record; story; personal reflection; everyday; project; progress; development. **B2) Inspiration / enjoyment** Use Flickr for it's use as an inspirational repository, where the user can search for, browse, view and admire other people's images either for work or project related inspiration OR because they just enjoy browsing through other people's images. Typically expressed with terms such as: other people's images; inspiration; ideas; database; enjoy; fun.
	Social	**C1) Sharing, maintaining relationships, and group memory** Use Flickr so that other people can view and access the photos uploaded. This could be to share images with the general public OR people from a mutual shared experience such as a party or get together, OR to share with absent friends and family as a way of keeping in touch and maintaining social relationships (e.g., sharing pictures of a new born baby with friends/relatives who live elsewhere). Typically expressed with terms such as: share; experiences; discover; friends; family; keep in touch. **C2) Ad hoc photo pooling** Use Flickr to contribute images to a group pool which has been set up specifically for a particular event (e.g., a conference group, workshop, wedding, party etc) this can be to either share the images with other people who attended the event, or as a way of reporting back on the event for people who didn't attend. Typically expressed with terms such as: group; event; pool; workshop; conference(s).	**D1) Social signalling / attention** Use Flickr to promote the images uploaded and to draw attention to them from either: other photographers, other like-minded people or media agencies in order to gain comments and feedback or even potential payment for images or potential work OR in order to connect socially with like-minded Flickr users with similar interests or hobbies (usually via the use of special interest groups on Flickr). Typically expressed with terms such as: other photographers; like-minded people; social; groups; promote my work; showcase; portfolio; picked-up; connect; reputation; community; feedback; advice; comments. **D2) Self expression** Use Flickr to give a voice to one's own unique view of the world and concerned with uploading expressive and experimental images which somehow express the views/feelings of the image uploader OR in order to group together and present a selection of one's favourite and best images OR in order to present images which are found to be funny or humorous. Typically expressed with terms such as: experimenting; express myself; favourite; best; images I like; aesthetically pleasing; my view/perspective; humour; funny. **D3) Self presentation** Use Flickr in order to present an aspect of the user's personality or identity (perhaps by using it to display/host images from a personal blog or website or to present images which show the respondent engaging in a particular activity or associating with certain people) OR to keep track of and document aspects of day to day life/experiences with the intention of wanting such images to be seen by other people. Typically expressed with terms such as: self-portrait; personal; my image; everyday; blog; website; hobbies; interests; my life; social identity.
		E) Unable to determine The respondent has not provided enough information for a judgement to be made OR The respondent has expressed why they *like* Flickr rather than why they *use* Flickr (e.g., it's free and easy to use)	

Figure 6-3 Content analysis scheme for motivation to upload images to Flickr

The second classifier was given a random sample of 46 respondents' answers to question 3 ("Please briefly explain why you upload your images to Flickr"), along with the content analysis scheme and a brief set of instructions on what to do. In order to calculate Krippendorff's alpha the subcategories were merged (e.g., B1, B2 merged to B) as otherwise there would have been too many potential categories for the results of the Krippendorff alpha to be meaningful. The categories were treated as binary, with the potential for each respondent in the 10% sample to be assigned to one of 16 possible overall categories (i.e., was the respondent motivated by: A, B, C, D, AB, AC, AD, BC, BD, CD, ABC, ABD, ACD, BCD, CBD, or E).

Using the second set of classified answers, test-retest reliability was measured using Krippendorff's alpha, which was calculated as 0.89. A Krippendorff alpha score of over 0.8 is considered an acceptable level of reliability (Krippendorff, 2004).

6.1.3 Method objective D

6.1.3.1 Classification scheme (types of tags users' assign to their images)

No research has been published to date that specifically draws on both image interpretation and elements specific to web 2.0 images in order to produce a tag classification scheme for web 2.0 images. Previous research has tended to focus on image interpretation and the meaning in visual content, and also the classification of tags on linguistic or statistical grounds. It was therefore necessary to develop a bespoke classification scheme for the analysis of image tags in Flickr (See Table 6-3). This classification scheme was developed as part of the preliminary study *General patterns of tag usage among university groups in Flickr*. The results from the preliminary study highlighted that the bespoke scheme developed was not a perfect match for tags used within Flickr as no tags were found to fall under the task-organising category (C3), Kipp (2007b) also found that this was not a popular tag choice. However, it was realised that this could be attributed to the nature of content stored within Flickr (i.e., images rather than text-based resources). This category was therefore omitted from the final classification scheme used in the principal investigation.

Category B1c was added to the classification scheme (tags that identify inanimate objects/gadgets/brands). This addition was based on the emergence of 'ephemera' photography in relation to cameraphones and some of the new genres of image content that are increasingly being captured (e.g., objects of interest, gadgets). An additional new category was also added, C1 (tags relating to techniques and methods). This category is reflective of the nature of photography on Flickr, where many serious amateur photographers like to indicate what equipment (type of camera, lens etc.) they have used in order to take certain images or what post-processing techniques have been applied to images. There are also a number of automatically generated tags that are applied directly from the camera or the cameraphone app that was used to take the image. In light of this addition, some of the categories in the C section of the original classification scheme were renumbered.

6.1.3.1.1 Reliability – Krippendorff's alpha

A second classifier was used to classify approximately 10% of the final sample and this consisted of 355 image URLs, with a total of 1,366 accompanying tags. Test-retest reliability was measured using Krippendorff's alpha, which was calculated as 0.85. A Krippendorff alpha score of over 0.8 is considered an acceptable level of reliability (Krippendorff, 2004).

6.1.4 Method objective E

6.1.4.1 Comparison of questionnaire data with Flickr data

The data gathered from both the questionnaire and the automatic collection of Flickr data were processed in four main ways:

1. The Likert-scale items in the questionnaire that related to users' motivations for tagging images were subjected to reliability analysis (Cronbach's alpha) and factor analysis in order to test for their reliability, validity, and consistency and to see how the question items related to one another.
2. The answers from the free-text section of the questionnaire that related to users' motivations for uploading images to Flickr were classified using the content

analysis scheme as outlined in section 6.1.2.1. A second classifier also classified a random 10% sample of the answers.

3. Descriptive statistics were generated from the answers to the contextual questions on the questionnaire (e.g., age, gender, country of origin etc.).
4. The images and tag data collected via the Flickr API were classified using the tag classification scheme as outlined in section 6.1.3.1. A random 10% sample of the image and tag data was also classified by a second classifier.
5. The data set was then analysed using multinominal logistic regression. Regression analysis is a statistical technique that can determine the predictive strength of certain independent variables against a dependent variable. Whereas linear regression works with variables that are continuous (i.e., interval or scale data), multinominal logistic regression works with data where the dependent variable is nominal (or categorical) and can consist of more than two possible outcomes (i.e., Flickr users could be assigned to one of a number of different possible tag categories), and where the independent variables can be a mixture of nominal, ordinal, and interval level data (i.e., gender, Likert scale responses, age). Logistic regression describes the contribution of each variable on the outcome (i.e., the contribution of factors such as motivation, age, gender etc, on tagging practice). Logistic regression also describes the direction of the contribution, and whether the odds increase or decrease the likelihood of a certain outcome occurring (Hair et al., 2006, p. 381). This was therefore the most appropriate statistical test to use given the nature of the data in this investigation and the aim of wanting to determine the effect of a range of variables on tagging practice. Although in essence there were three different samples that made up the final data set, the three subsamples were a result of the effort to obtain a large enough overall sample size. As the aim of this thesis investigation was not to look for patterns, similarities, or differences between the three subsamples they will therefore be combined and discussed as the overall final sample, however, an additional logistic regression analysis will be performed to determine to what extent the three different samples may have biased the results.

Table 6-3 Refined tag classification scheme

A		**Generic relationship between tag and image content**
	1	Tag identifies what image is **of** at its most primary and objective level – very little subject specific knowledge is needed to make this distinction (e.g., an image of a cat, tagged as 'cat' or 'animal'; an image of some artwork tagged as 'illustration' or 'painting'). Also, images that heavily feature a particular colour (e.g., an image of a blue cloudless sky tagged as 'blue').
B		**Specific relationship between tag and image content**
		Tag identifies what image is **of**, but familiarity or some existing knowledge is needed to make this connection, and to a certain extent an assumption has to be made about this connection.
	1(a)	Tags that identify place names/events – an image of the Eiffel Tower in Paris tagged as 'Eiffel Tower' requires knowledge acquired from familiarity with the specific place in question. Assumptions have to be made that an image tag is what it claims to be if the image is not familiar.
	1(b)	Tags that identify people/animals – an image of Elvis Presley tagged as 'Elvis Presley' requires knowledge and familiarity of Elvis Presley. Distinctions cannot always be made between 'famous' people and 'non-famous' people, therefore the assumption has to be made that an image of a girl, tagged as 'Sarah' is in-fact an image of a girl who is called 'Sarah'.
	1(c)	Tags that identify inanimate objects/gadgets/brands – an image of a music player tagged as 'iPod' or an image of a plant tagged as 'begonia' requires knowledge acquired from familiarity with the subject in question or from cultural knowledge
	2	Tag identifies what the image is **about** Typically expressed by the use of abstract nouns or adjectives - an interpretation is made of what the image is about (e.g., image of people smiling tagged as 'happiness'; image of cars on a motorway tagged as 'speed').
C		**Technique and methods**
	1	Tags that relate to techniques or methods associated with the taking of the image itself. e.g., camera model, type of film used, ISO numbers, aperture settings, image properties (black & white, sepia, portrait) effects applied to the image (HDR, tiltshift), apps that were used to take the image (instagram, shozu, camera +), geotags, information relating to who did hair & make up for model shoots.
D		**Refining tags**
	1	Cannot stand alone Tags that are only useful when looked at as part of the larger tag set (e.g., a series of collective images, each with a specific number or letter; or dates)
	2	Self-reference tag Tags that identify image content in terms of its relation to either the tagger or the specific group that the image belongs to (e.g., 'my dog'; 'daughter', 'our graduation') OR tags that appear useful, (i.e., are valid words) but show no relationship/connection to the accompanying image.
	3	Tag that explicitly denote ownership of the image (e.g., image tagged with the same username as that of the person who uploaded the image).
	4	Compound tag (concept phrases) Tags where words, phrases and sentences are joined together as one long text string.
E		**Miscellaneous categories**
	1	Misspelling (e.g., 'Belguim' instead of 'Belgium') Whilst it may be obvious what the tag is meant to be, a misspelling obviously renders the tag useless in terms of subsequent users of the system who are searching for images with that specific tag, unless they too misspell the tag/word.
	2	Unable to determine relationship Despite having attempted to look up either the meaning of the tag and whether the tag is a foreign word or not, tags which do not fit into any of the above categories will be deemed as unable to classify (e.g., nonsensical words).
	3	Foreign word/character

6.2 Evolution of the research methods

The preliminary studies chapter documents two investigations that were carried out as part of this thesis investigation that were designed to broadly test the suitability of Flickr for an

investigation into web 2.0 images and tagging. Both studies were designed to specifically focus on tagging and what could be inferred about motivation directly from tags rather than focussing on a user perspective and user motivation for uploading and tagging images in Flickr. The two preliminary studies were therefore predominantly informetric in nature, and investigated aspects such as the power law distribution of the tags investigated, tag exhaustiveness, and term-frequency analysis. The preliminary studies did not make use of questionnaires or in directly asking Flickr users about their tagging practices or motivation for tagging. This distinction means that the preliminary studies have a very different approach and use of methods to both the pilot study and the final principal investigation. The reason for this difference in approach is due to the natural evolution of the thesis investigation as it progressed.

At the beginning of the thesis investigation, it was envisaged that tagging motivation could be assessed via the development of a classification scheme that analysed the relationship between a tag and its accompanying image. However, as the preliminary study *General patterns of tag usage among university groups in Flickr* found, 'many tags could lie between categories or equally well in multiple categories,' and the use of tags that can be deemed as useful to the rest of the Flickr community, can be the result of either self or social motivations on behalf of the Flickr user. This finding led to the realisation that whilst tag analysis could give an indication as to the reasons behind uploading and tagging images on Flickr, this would ultimately result in a limited viewpoint, making it very difficult to determine motivation with any certainty. Ultimately, an investigation that seeks to understand motivation has to include the interrogation of Flickr users themselves as well as looking at their images and tags.

This change in the research process and the decision to include a questionnaire asking people directly why they upload their images to Flickr and why they tag them, led to a reassessment of the literature review, and the inclusion of work that looked at why people take photographs in the first place and the function of photography within society. This explains why the literature review chapter is split into three main sections: the first and second sections look at the image itself (motivations for taking images, and motivations for uploading images online), with the third section focussing on the original intention of the research investigation, tagging (the function of tagging, and motivations for tagging images).

Whilst this change in method for the thesis investigation creates a divergence in the approaches of the preliminary studies compared to the pilot study and principal investigation, it is nonetheless reflective of the natural evolution of a research investigation. The discovery of new information and results helps to inform subsequent stages of the research and can ultimately assist in developing the most robust research method for meeting the aim and objectives of the research investigation.

7 Results

The results chapter is divided into five main sections. Firstly, descriptive statistics are presented to show the demographic spread of the overall sample of respondents that completed the questionnaire. This is followed by two sections on the results and analysis of the two main questions in the questionnaire that were designed to answer the two main research questions of the thesis: what motivates users to upload their images to Flickr; and what motivates users to tag their images in Flickr. The fourth section provides the results from the tag classification that was intended to determine the tagging practice of the Flickr users that completed the questionnaire. Lastly, inferential analysis of the results is presented in order to determine what effect motivation to upload and tag has on tagging practice.

7.1 Descriptive statistics

Respondents who did not provide their Flickr screen names are included in the descriptive analysis. The only respondents omitted from this section of the results are those that skipped some of the demographic questions.

7.1.1 Gender

62.1% of the overall sample of 456 Flickr users were male, and 37.9% were female. No respondents skipped the question relating to gender.

7.1.2 Age

Only one respondent skipped the question relating to age, leaving a total of 455 respondents who answered, ranging in age from 14 – 72 years. As the data range for respondents' ages was not strongly skewed, it is appropriate to report the mean age in this instance (Vaughan, 2009, p. 31), which was 34 years old. Figure 7-1 presents the spread of age data by grouped age categories.

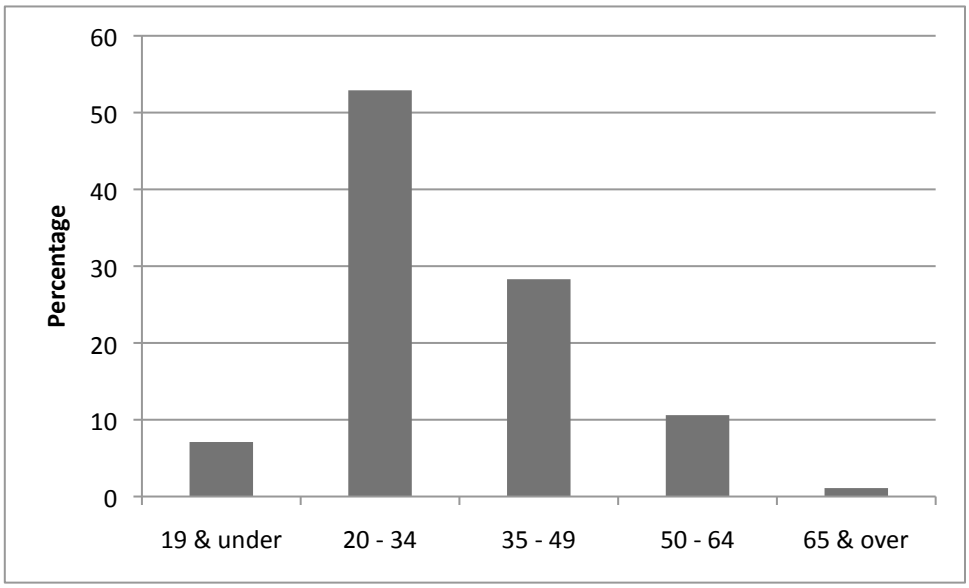


Figure 7-1 Age group percentages of Flickr users

7.1.3 Country of origin

Two respondents skipped the question relating to country of origin. The remaining 454 respondents came from a total of 56 different countries. Figure 7-2 shows the top five countries that respondents came from.

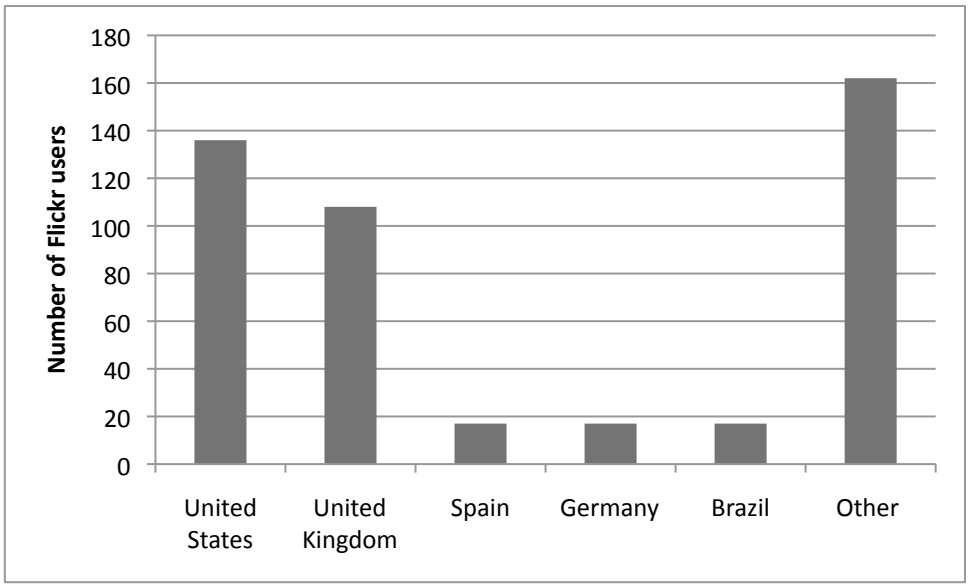


Figure 7-2 Top five countries that respondents came from

Figure 7-3 shows the spread of respondents via continent. From the European respondents, 53.5% came from the UK (24% of the total overall sample); and from the North American respondents, 88.9% came from the USA (30% of the total overall sample).

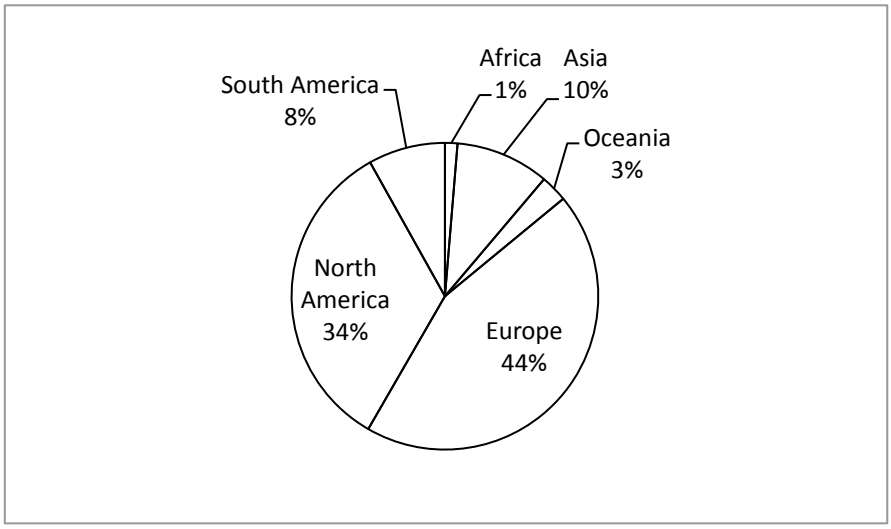


Figure 7-3 Percentage of respondents according to continent

7.1.4 Type of photographer

No respondent skipped the question that asked them to state what type of photographer they self-identified as. More of the respondents classed themselves as serious amateur photographers (55%) than casual snapshooters (41%) or professional photographers (4%) (see Figure 7-4).

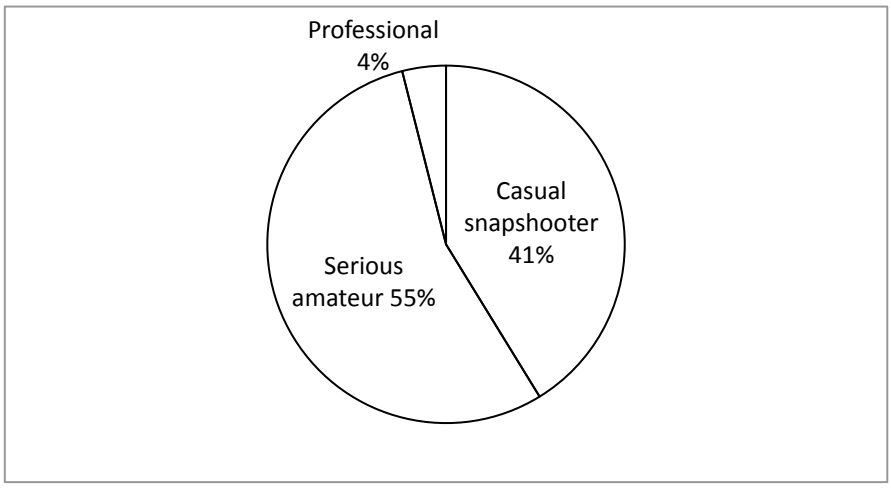


Figure 7-4 Percentage of respondents self-identifying as either casual snapshooter, serious amateur, or professional photographer

7.1.5 Number of groups

No respondents skipped the question that asked them how many groups they are a member of in Flickr. However, the range of answers given for this question was highly skewed, with the mode average number of groups being 0. The mean was 51.74, and the median 503.5. The skew of the answers is a result of a few respondents reporting that they were members of an extremely large amount of groups (one respondent claimed to be a member of 1007 groups). There is currently no cap on the number of groups a Flickr member can join, and a reported figure of 1007 groups can therefore be a plausible answer.

In order to deal with such skewed answers, a box plot was generated (see Figure 7-5) and the interquartile range was calculated. The interquartile range disregards the top and bottom quarter of the data, and reports the difference between the largest and smallest number in the remaining data (Vaughan, 2009, p. 35), this was found to be 47.5. However, the most interesting average to report in this instance is the mode, which indicates that 15.6% of the respondents in this sample were not a member of any groups. The second most popular number of group membership was one, with 8.8% of respondents being a member of only one group in Flickr.

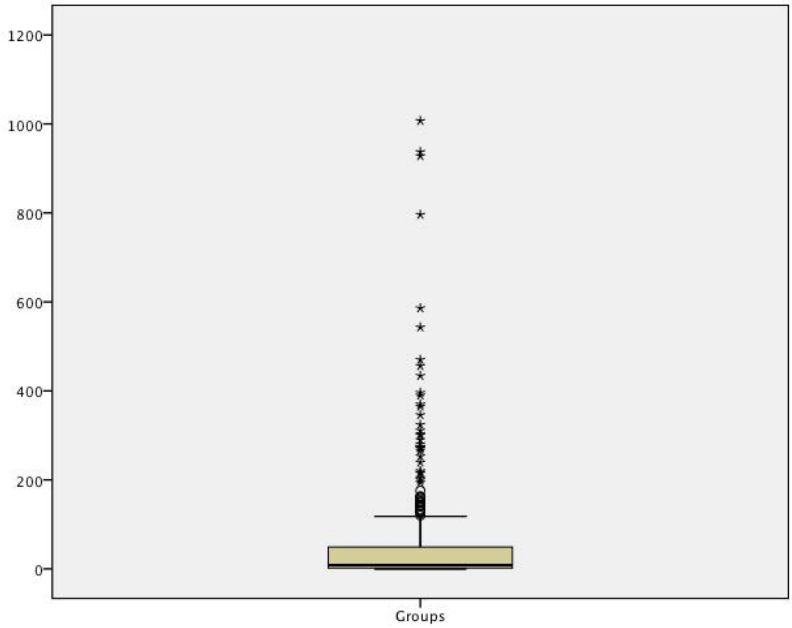


Figure 7-5 Box plot: Number of groups of which a Flickr user is a member

7.1.6 Number of contacts

No respondents skipped the question asking how many contacts they had, and similar to the question asking the number of groups the respondent was a member of, the answers to the question of how many contacts the respondent had was also highly skewed (see Figure 7-6). Again, the mode was found to be 0 (with 8.1% of respondents falling into this category), and the second closest number was five contacts (with 5.3% of respondents falling into this category). The mean average was 88.18 contacts, and the median 16.5, illustrating the highly skewed nature of the responses. The interquartile range was 76.75.

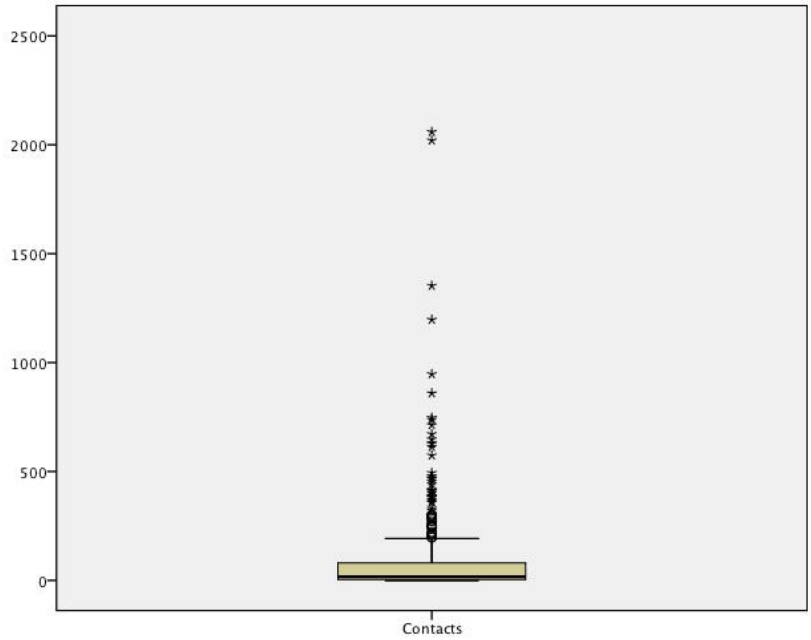


Figure 7-6 Box plot: Number of contacts a Flickr user has

7.1.7 Pro account and number of images

For the respondents who gave permission for their tag data to be retrieved, the API was also used to obtain data on the number of public images each user had and also whether or not they had a pro account. The API call method **flickr.people.getInfo** retrieved this information.

The sample of respondents was fairly evenly split between those with and without a pro account, 50.8% and 49.2% respectively.

The number of images a user had ranged from 1 to 33462. The information retrieved relating to the number of photos a user had excluded respondents that had deactivated their accounts or who had no public images available. It did however include those respondents that had public images but hadn't tagged them. A mode of 200 and a mean of 1038 indicate the extremely skewed nature in the number of images. A box plot was generated to visualise the skew in the data (see Figure 7-7). However, a mode of 200 indicates the maximum upload of images for Flickr users without a pro account, and a cross tabulation of the number of images and pro account status confirmed that all of the respondents without a pro account had 200 or fewer images. 18 respondents with a pro account also had 200 or fewer images, but the majority of respondents with a pro account (39%) had between 1001 – 5000 images.

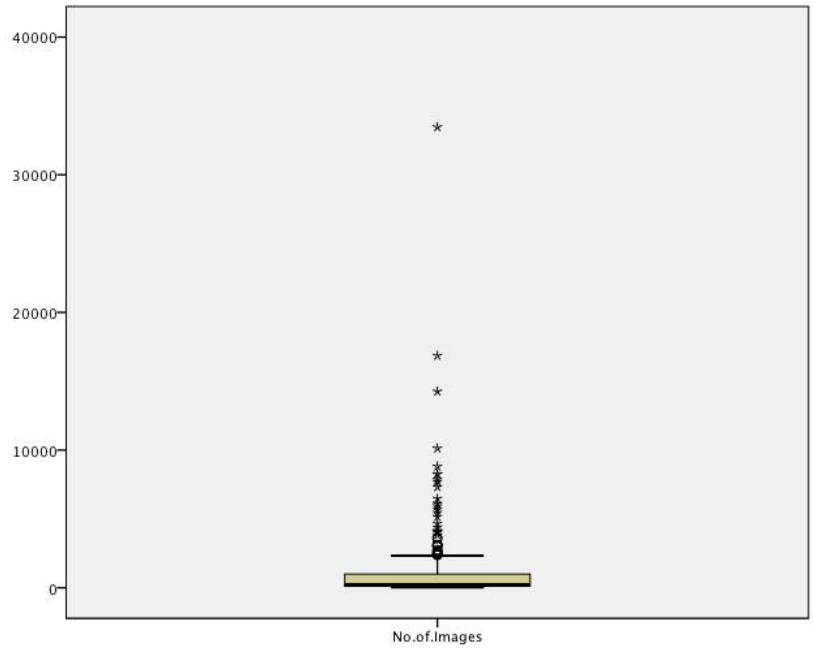


Figure 7-7 Box plot: Number of public images per respondent

7.2 Why users upload their images to Flickr (content analysis)

Question 1 of the questionnaire asked respondents to briefly explain why they upload their images to Flickr. Respondents were not allowed to skip this question, and regardless of whether or not respondents gave their Flickr screen names all 456 responses to this question are included in this section of the analysis. All respondents' answers were downloaded into an Excel spreadsheet and were manually read by the researcher. Using the content analysis scheme as presented in section 6.1.2.1 each respondent's reason(s) for

uploading their images to Flickr was first of all assigned to one or more of the specific subcategories (e.g., B1 – memory/personal reflection; C1 – sharing, maintaining relationships and group memory; C2 – ad hoc photo pooling), and their overall group category(s) was then listed in a separate column (e.g., B – self-communication; C – social-organisation). No emergent motivations were found from the responses given by the sample of Flickr users. The Krippendorff's alpha coefficient of inter-classifier agreement was 0.89. A Krippendorff alpha score of over 0.8 is considered an acceptable level of reliability (Krippendorff, 2004).

From the 456 respondents, 35 answers could not be classified. Either the answers were given in a language other than English, or the respondent had answered in an ambiguous way making it difficult to categorise their response with any certainty (e.g., 'Q: briefly explain why you upload your images to Flickr?' A: 'because I want to'). There were also some respondents who had answered this question in terms of why they specifically use Flickr (e.g., 'It's a free service and easy to use') rather than in terms of the ultimate purpose in uploading their images.

From the content analysis, over half of the respondents (60%) reported one clear motivation for their use of Flickr (see Figure 7-8). The remaining respondents had expressed a mixture of two, and in some cases three different reasons for why they upload their images to Flickr.

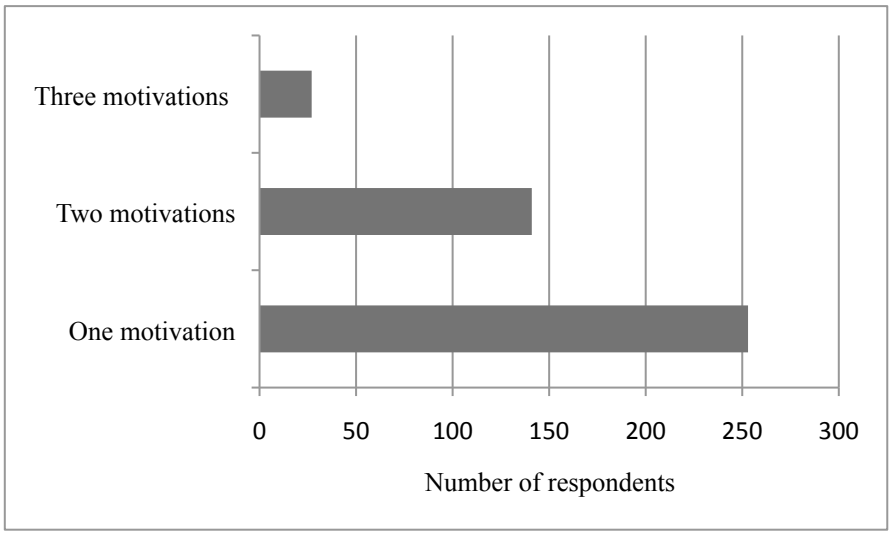


Figure 7-8 Number of motivations for uploading images to Flickr

For the respondents who had expressed only one main motivation, see Figure 7-9 for a breakdown of the most popular single motivation subcategories.

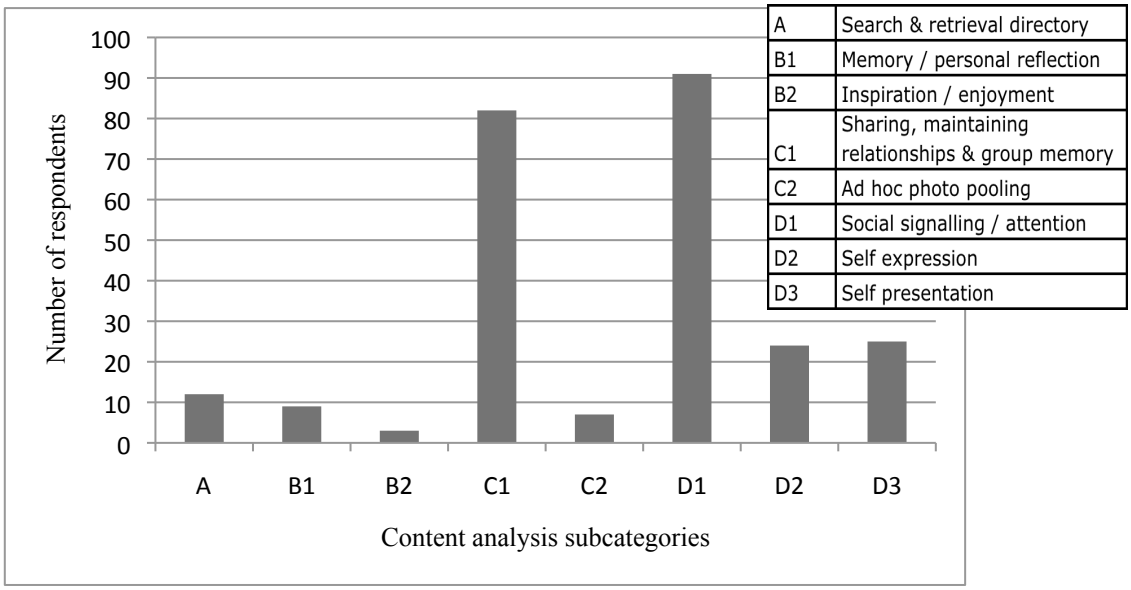


Figure 7-9 Breakdown of subcategories for respondents with one motivation for using Flickr

The most popular motivation was subcategory D1 (social signalling/attention), with 91 respondents (20.63%) stating that this was their sole main reason for uploading their images to Flickr. This category was typically expressed with responses such as:

> *"I want to be a photographer, but I'm just a teenager, so I connect with big photographers on Flickr - they give me advice and teach me about photography techniques. I also hope that someone will see my photos and give me a job opportunity to start my career."*

> *"I'm just starting out as a model photographer. I use Flickr to showcase my latest work. I like to gauge if my work is good or not from the comments it receives. I tag my work mainly so people can find my images."*

From the remaining respondents who had stated one main motivation for uploading their images to Flickr, category C1 (sharing, maintaining relationships, and group memory) was the second most popular, with 82 respondents falling into this category (18.6%). Categories D2 (self-expression) and D3 (self-presentation) came a close joint third, and had 24 and 25 respondents respectively. Typical responses to these three subcategories included:

Category C1

> *"Many of my friends live in New York therefore, I find it a great way for them to get a little taste of my life through my captured moments."*

Category D2

> *"To have a collection of my favourite photos to show my 'style'."*

Category D3

> *"I am currently using Flickr as an extension of my home business. Since I did not have the knowledge or the resources to create a technical website, I've linked my Flickr account with the website. This way, I can easily access and update my gallery pages without being a techie. And also, as an extension of my CV to showcase my portfolio when applying for jobs."*

Whilst it was interesting to look at the split of subcategories for those respondents with one motivation, the results became unwieldy when looking at the split of subcategories for respondents with two and three motivations resulting in a large spread of different combinations of subcategory groupings, each with a very small percentage of respondents who were assigned to that particular subcategory(s) grouping combination. It therefore became necessary to merge the subcategories into their overall group category in order to create more meaningful results (e.g., D1, D2, and D3, became category D: social-communication). See Figure 7-10 for an overview of the merged category combinations for respondents with one, two and three motivations for uploading their images to Flickr.

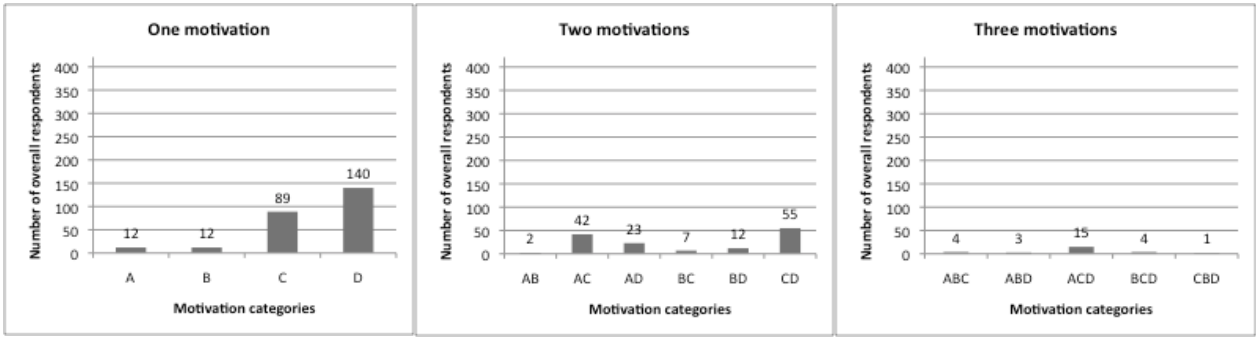


Figure 7-10 Merged category combinations for respondents with one, two, and three motivations for uploading their images to Flickr

For the respondents with only one main motivation, categories D1, D2, and D3 combined accounted for 140 people's responses (31.75%), indicating that social-communication is

the sole driving force behind over a quarter of the total respondents motivation for uploading their images to Flickr.

141 respondents (31%) reported two reasons behind their use of Flickr, and the most popular two merged categories were C and D (social-organisation and social-communication), with 55 respondents (12.1%).

27 people (5.92%) reported that they had three reasons for using Flickr, and the most popular three merged choice combination was category A, C, and D (self-organisation, social-organisation, and social-communication), with 15 respondents (3.3%) falling into this category.

Whilst only 12 respondents (2.6%) reported that they use Flickr solely for the purpose of search and retrieval directory (category A), a total of 101 respondents (22.15%) reported that they use Flickr for search and retrieval purposes in conjunction with another reason, with typical responses such as:

> *"I use Flickr as a backup for my photos, as well as a way of sharing with family and friends."*

> *"I mostly upload pictures for personal use and to keep them somewhere besides on my hard drive, also it's an easy way to share my pictures with family and friends. And to use them when I'm travelling."*

> *"I am building up my photography portfolio with the eventual aim of having to sell my images online one day. I also add the images that I do not want stored in my computer but will want to have access to in the future."*

Only 12 respondents reported that they use Flickr solely for self-communication reasons (category B1: memory/personal reflection and category B2: inspiration/enjoyment) with responses such as:

> *"Partly as a record or lifestream for my own, selfish purposes…it's now more a journal of life."*

> *"I want to try to broaden my view in the art of photography. It's a real treasure trove of photographic samples."*

Even when combined with other reasons, only 45 respondents mentioned the use of category B1/B2 out of the total 421 respondents whose answers could be classified.

In splitting the content analysis groupings back into their respective subcategories and looking at the top three overall reasons for uploading images to Flickr across respondents with one, two and three motivations, it becomes clear that category A (self-organisation) is more popular than it appeared to be at first (see Figure 7-11).

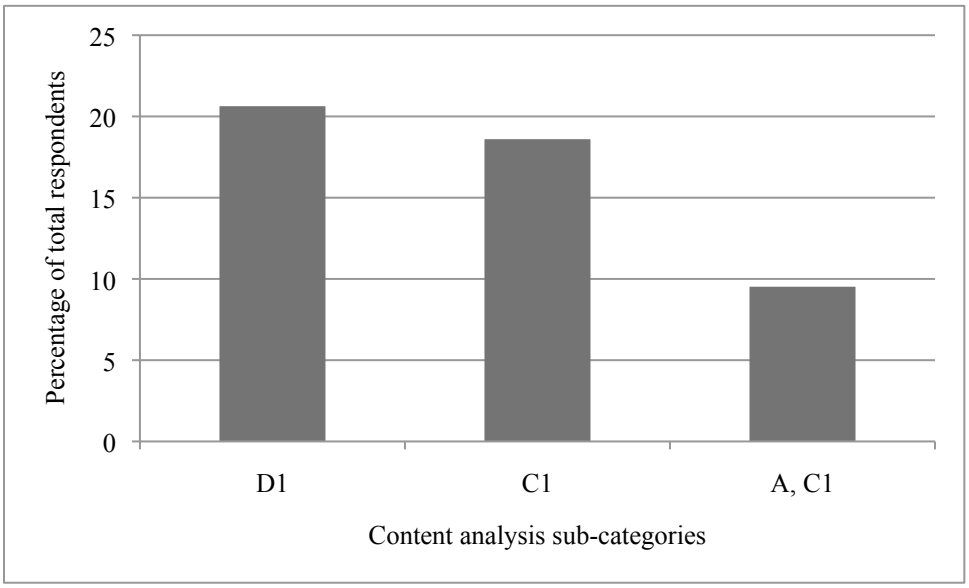


Figure 7-11 Top three overall motivations for uploading images to Flickr (%)

However, after merging all of the individual subcategories together into their overall groupings, it is clear that social-communication and social-organisation are the most popular reasons for using Flickr (see Figure 7-12).

A cross tabulation of motivation to upload and pro account status indicated that respondents with a pro account were 1.8% more likely to be motivated by self-organisation than those without a pro account but this was not a statistically significant finding.

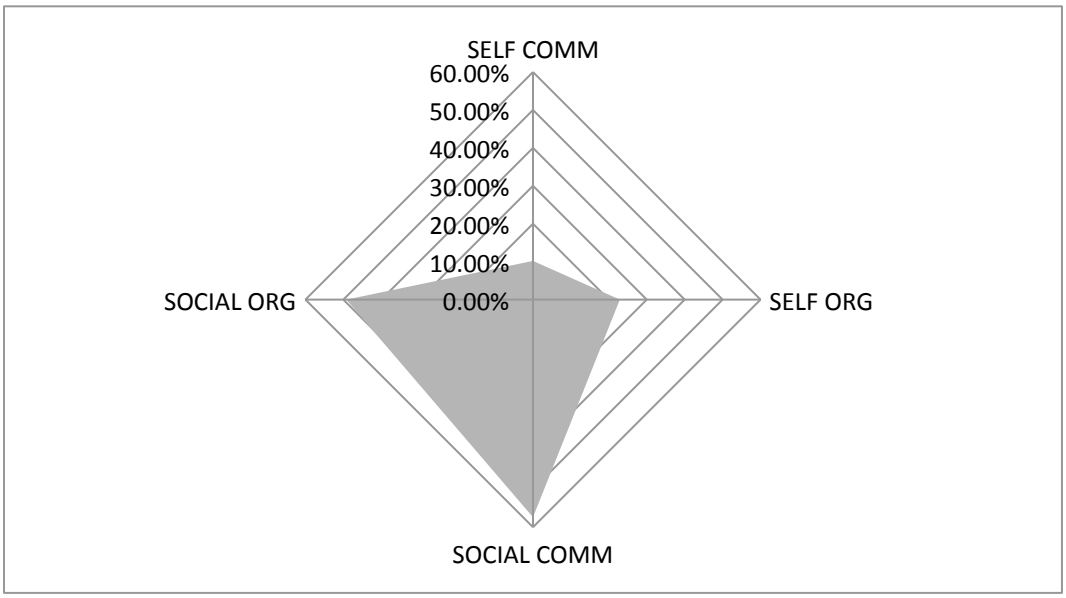


Figure 7-12 Why users upload their images to Flickr

7.3 Why users tag their uploaded images

Question 2 of the questionnaire asked respondents to indicate to what extent they agreed/disagreed with a series of eight statements that had been designed to measure motivation for tagging images. Respondents were asked to indicate their level of agreement/disagreement using a 5-point Likert scale (1 – strongly agree / 5 – strongly disagree). Each statement measured one of the four individual elements that make up the four overarching constructs of motivation as detailed in section 5.1.2.3 and there were two statements per element.

7.3.1 Reliability – Cronbach's alpha

As highlighted in the results section of the pilot study (see section 5.1.3), with questionnaires, it is important that the questions included within a particular scale (or set of questions measuring a construct) are reliable (i.e., consistent). Reliability is defined as the extent to which a set of variables is consistent in what it is intended to measure (Hair et al., 2009, p. 137). Hair et al. (2009, p. 102) deem that the lower level of acceptability for Cronbach's alpha scores is .60, therefore the questions used in the pilot study were all found to be reliable measures of the singular motivation constructs with alpha scores of: self .658; social .765; communication .615; and organisation .688. However, the pilot study was only conducted on a small sample of users (n=33) and the sample was also slightly

biased towards Flickr users from the UK and Denmark. Therefore the alpha scores were calculated again using the responses from the principal questionnaire. The eight motivational statements that were designed to test the elements of self, social, communication and organisation were therefore tested for internal consistency using Cronbach's alpha split-half reliability in order to measure if responses from the same person correlated highly with each other. The eight statements consisted of four pairs of statements designed to measure the four underlying constructs of self, social, organisation and communication. The four pairs were treated as four separate scales consisting of two items each and the four scales were tested for their internal consistency. The alpha scores are presented in Table 7-1 (rows 1-4).

Hair et al. (2009, p. 102) deem that the lower level of acceptability for Cronbach's alpha scores is .60, therefore in this instance the scales relating to communication and self do not have internal consistency. Cronbach's alpha indicates that the two questions relating to organisation are at the lower end of acceptability, with only the questions relating to social having strong reliability. However, much of the literature warns that Cronbach's alpha increases in size when the number of items in a scale increases (Gliem & Gliem, 2003; Hair et al., 2009, p. 137); so high alpha scores in such cases should always be treated with caution (Hair et al., 2009, p. 137). Conversely, it can be said that a scale (or construct) with few items (questions) will tend to result in a low Cronbach's alpha score, and as the scales being measured here only consist of two items each, it is unsurprising that low alpha scores were reported for three out of the four scales being measured.

However, Cronbach's alpha is not a test for the unidimensionality of a scale and therefore the items being tested can represent more than one concept (Gliem & Gliem, 2003). As the four pairs of items in this scale (i.e., self, social, communication, organisation) were ultimately measuring constructs that were a combination of the pairs (i.e., self-communication, self-organisation, social-communication, social-organisation) alpha was measured again on the four pairs of four items, and this also assists in resolving the problem of having too few items in the measurement. The revised Cronbach's alpha scores are presented in Table 7-1 (rows 5-8).

Table 7-1 Cronbach's alpha scores for the principal questionnaire

	Cronbach's Alpha	No. of items
Construct of Self	0.235	2
Construct of Social	0.775	2
Construct of Organisation	0.696	2
Construct of Communication	0.464	2
Construct of Self-organisation	0.481	4
Construct of Social-organisation	0.666	4
Construct of Self-communication	0.136	4
Construct of Social-communication	0.734	4

The alpha for self-organisation was also low (.481). However, an item should be dropped from a scale if the alpha increases significantly when it is removed (Gliem & Gliem, 2003). For the construct of self-organisation the Item-total statistics table (see Table 7-2) indicated that the alpha would increase from .481 to .623 if the SELF 2 item was removed.

Table 7-2 Item-total statistics and alpha if item deleted for self-organisation

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
ORG1	8.42	4.626	.387	.293	.309
ORG2	8.41	4.459	.398	.319	.293
SELF1	8.47	4.540	.340	.121	.348
SELF2	7.18	5.969	.036	.025	.623

Similarly, the SELF 2 item had a negative effect within the construct of self-communication, with the alpha score rising from .136 to .349 with its removal.

In combining the pairs of items to make up the four overall constructs of motivation and in removing the SELF 2 item, the alpha scores increased to: .734 (social-communication); .666 (social-organisation); .623 (self-organisation); and .349 (self-communication). This indicates that social-communication, social-organisation, and self-organisation (with the removal of the SELF 2 item) are reliable constructs and the questions contained in the

questionnaire reliably measure these particular motivations. However, even with the removal of the SELF 2 item, the items relating to self-communication were not found to be a reliable construct and consequently the figures need to be treated with caution.

Yu (2001) advises that low Cronbach's alpha scores may also be a result of a question that negatively correlates with the other items in the scale as a result of the question being worded in the negative. The SELF 2 question item was worded negatively (i.e., when I tag my images **I do not** think about how useful the tags will be to other people'). However, Oppenheim (1992, p. 181) explains that the incorporation of sets of both positively and negatively worded questions is not a bad thing as this can be used as a mechanism to try to overcome social desirability bias (where respondents answer in a way that they think will portray them in a better light). Yu (2001) claims, however, that it is a common misconception that low alpha scores immediately equate to a bad test. A low Cronbach alpha score may indicate the existence of several latent constructs/attributes/dimensions at play within a scale rather than one. These issues were further investigated with a factor analysis.

7.3.2 Exploratory factor analysis

Due to the low Cronbach's alpha scores relating to the SELF 2 question item and the construct of self-communication, an exploratory factor analysis was conducted. Factor analysis can be used to investigate how questionnaire items naturally cluster together, perhaps indicating different constructs to what the theory (or literature) suggests. Although a factor analysis had been conducted on the questionnaire in the pilot study, the pilot study sample was fairly small (n=33), and the test had not been conducted in relation to the discovery of low Cronbach's alpha scores.

Whilst factor analysis is often used as a way of reducing an excess number of variables in a large pool of question items, it achieves this by enabling 'us to find out what (if any) are the underlying dimensions of a set of variables, attributes, responses or observations' (Oppenheim, 1992, p. 166), and it was therefore an important procedure to undertake in order to investigate how the four single constructs (self, social, communication, and organisation) were related to each other.

A factor analysis (using principal components analysis) was performed on the results for question 2 of the questionnaire (i.e., 'please indicate to what extent you agree/disagree with each of the following statements'). The statements related to the motivational constructs of self, social, communication and organisation. Each construct consisted of two statements that although worded in different ways, were designed to essentially ask the same thing. Respondents had to agree/disagree with each of the statements using a 5-point Likert scale. The factor analysis was intended to determine to what extent the pairs of statements that were intended to ask the same thing correlated to each other, and to what extent was the level of any intercorrelation that existed across the four pairs of statements. The SELF 2 question was retained in the factor analysis in order to investigate how it correlated with all of the other question statements.

Table 7-3 below shows a Kaiser-Meyer-Olkin (KMO) score of .742, which indicates that 74% of the variance in the eight questionnaire items is shared variation. Pallant (2002) states that KMO should ideally be above .6 for factor analysis and therefore a score of .742 affirms that the variables are suited to factor analysis. Bartlett's test of sphericity tests the null hypothesis (i.e., that the variables have no correlation between them at all). As the significance value is below 0.05 the null hypothesis can be rejected and it can be assumed that there is correlation between the variables, thus again justifying the use of factor analysis.

Table 7-3 KMO and Bartlett's

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.742
Bartlett's Test of Sphericity	Approx. Chi-Square	932.674
	df	28.000
	Sig.	.000

The correlation matrix (Table 7-4) confirms that respondents answered very differently on the two statements relating to the construct of self (.133), which confirmed the low alpha score for these two statements (.235). The negative correlations between the self and social items are indicative of the fact these are polar opposite of each other. Field (2000, p. 444) advises that it is important that the matrix shows some correlation between items but this should not be too high as this could indicate multicollinearity or singularity, (where items are either too dependent on each other, or have no correlation at all with any other item)

which would make factor analysis an unsuitable procedure and make it difficult to determine the contribution of items within the questionnaire. Based on the values in the correlation matrix, all items were therefore retained in the analysis to further explore their correlation to each other and their contribution to the questionnaire as a whole.

Table 7-4 Correlation matrix

	SELF1	SELF2	SOCIAL1	SOCIAL2	COMM1	COMM2	ORG1	ORG2
SELF1	1.000	.133	.035	-.094	.227	-.010	.245	.299
SELF2	.133	1.000	-.459	-.436	-.274	-.110	-.015	-.043
SOCIAL1	.035	-.459	1.000	.632	.578	.352	.253	.237
SOCIAL2	-.094	-.436	.632	1.000	.394	.259	.163	.211
COMM1	.227	-.274	.578	.394	1.000	.309	.264	.258
COMM2	-.010	-.110	.352	.259	.309	1.000	.221	.185
ORG1	.245	-.015	.253	.163	.264	.221	1.000	.534
ORG2	.299	-.043	.237	.211	.258	.185	.534	1.000

The communality scores displayed in Table 7-5 indicate that the SELF 2 statement (with a communality of .545) should be retained in the questionnaire, despite its low Cronbach's alpha score. The communalities represents the proportion of variance in a variable accounted for by the factors – variables with small communalities (say 0.2 or below) have little in common with other variables and should be removed from the analysis (Kline, 1994, p. 45).

Table 7-5 Communalities

	Initial	Extraction
SELF1	1.000	.497
SELF2	1.000	.545
SOCIAL1	1.000	.759
SOCIAL2	1.000	.658
COMM1	1.000	.544
COMM2	1.000	.271
ORG1	1.000	.599
ORG2	1.000	.617

The COMM 2 item had the lowest communality, with a score of .271, meaning that the variation in the scores the respondents gave to this particular question is unexplained by the factors extracted in the analysis and has very little in common with the other items. Referring back to the Cronbach's alpha score for the construct of communication, the two items only achieved a score of .464, and so it is evident there is a potential problem with the COMM 2 item and thus it is necessary to revisit the question wording of the COMM 2 item to investigate whether its low communality is due to possible ambiguity in how the question is worded.

The COMM 2 item was designed to ask if communication is an important aspect in tagging images, and the question wording was: *I tag my images as a way of enhancing what is contained within the image.* The Oxford English Dictionary defines the word 'communication' as, 'the imparting or exchanging of information' (Oxford Dictionaries, 2010a), whereas the word 'enhance' is defined as, 'to intensify or increase something' (Oxford Dictionaries, 2010b). Therefore on closer inspection of the word definitions, it seems that COMM 2 is asking something different to COMM 1. Whereas COMM 1 is asking about imparting information, COMM 2 is essentially asking about subtly changing information, and it is therefore easy to see how this question wording could have been unclear or ambiguous to respondents. Based on this ambiguity, the COMM 2 item was removed from the questionnaire and the factor analysis was resumed with the seven remaining question items.

Table 7-6 indicates the percentage of variance accounted for by each factor. Only factors that have eigenvalues greater than 1 are normally considered significant (Kaiser, 1960). Eigenvalues of 1 indicate that a factor explains the same amount of variance (or information) as one variable; factors were dropped if their eigenvalues were below 1. A core goal of factor analysis is to 'achieve parsimony by using the smallest number of explanatory concepts to explain the maximum amount of common variation' (Tinsley & Tinsley, 1987). Two factors were retained in this solution.

This meant that in reducing the number of constructs (motivations) from four to two, 61% of the original variance could be retained. Factor 1 explained 34% of the variance in the seven retained items and factor 2 explained 26% of the variance. Factor 1 is therefore

slightly more important in terms of explaining the information gathered via the Likert scale than factor 2.

Table 7-6 Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.681	38.302	38.302	2.681	38.302	38.302	2.417	34.523	34.523
2	1.614	23.064	61.366	1.614	23.064	61.366	1.879	26.842	61.366
3	.838	11.973	73.338						
4	.608	8.693	82.031						
5	.511	7.298	89.329						
6	.439	6.270	95.599						
7	.308	4.401	100.000						

In order to interpret the two-factor solution, factor rotation is required. Factor rotation is a way of redistributing the variance explained by the extracted factors in order to formulate a more meaningful and interpretable solution (Kieffer, 1998). Orthogonal rotation is preferred when factors are believed to be uncorrelated, and oblique rotation should be used when it is expected that the factors will have a level of correlation with each other (Kieffer, 1998). However when the ratio of factors to variables is small and the correlation coefficients are close to zero, both rotation strategies will yield similar if not identical results (Kieffer, 1998). The advantage of orthogonal rotation is that it tends to produce a clearer separation of factors and so can be more easily interpreted and replicated. As the factors in this analysis were correlated with each other (i.e., self-communication, self-organisation, social-communication, social-organisation) and as the ratio of factors to variables was small, both orthogonal and oblique rotations were performed. A two-factor solution was suggested in both instances. Kieffer (1998) claims that if the differences between the results from orthogonal and oblique rotations are negligible, then the orthogonal interpretation can be presented, as it is the easiest to interpret. Only factors with two or more items and a factor loading of more than .3 should be retained in the solution (Tabachnick & Fidell, 2007).

Table 7-7 provides an interpretation of the two-factor solution and indicates that rather than the four underlying constructs of self-communication, social-communication, self-organisation and social-organisation, there are only two main underlying constructs (based

on eigenvalues of above 1). The statements that related to social and communication 1, loaded highly onto factor 1. The SELF 2 item had a significant negative loading on factor 1, thus indicating it is strongly not associated with this factor, and this can be attributed to the negative wording of this question as it is essentially asking - *are you 'not' a social person?* - rather than - *are you a self person?* – and hence this explains why it did not load onto factor 2, but why it still had a moderate communality value (i.e., it shared negative communality with other items in the scale). The statements relating to organisation and SELF 1, loaded highly onto factor 2, and whilst the COMM 1 item also loaded onto this factor, as it is only just above .3 it is low enough to discard. Thus factor 1 could be described as social-communication, and factor 2 as self-organisation.

Table 7-7 Rotated component matrix

	Component	
	1	2
SOCIAL1	.851	
SOCIAL2	.822	
SELF2	-.735	
COMM1	.627	.394
ORG2		.772
ORG1		.756
SELF1		.692

This finding contrasts with the results from the pilot study, which gave a three-factor solution. However, whereas the factor analysis for the pilot study only included 33 participants, the factor analysis for the principal questionnaire included 456 valid participants and can therefore be seen as more reliable. Dancey and Reidy (2004, p. 417) advise to have at least 100 participants for conducting a factor analysis and to have five times as many participants as variables, this factor analysis was therefore above those recommendations.

The low Cronbach's alpha score for communication on its own, and also for self-communication, as well as the low factor loading for communication in the second factor (self-organisation) is indicative of the way people think about tagging in Flickr. People either think of tagging in a very social communicative way (tagging to attract attention to

their images), or in an organisational way (communicating aspects of the image to aid with its classification and grouping), rather than communicating to oneself in a diary or journal style fashion or for personal reflection – self-communication is not a coherent construct in relation to tagging motivation in Flickr.

7.3.2.1 Summary of the two-factor solution

Table 7-8 provides a summary of the two-factor solution. Factor 1 is social-communication (consisting of question items: SOC 1, SOC 2 and COMM 2) and factor 2 is self-organisation (consisting of question items: SELF 1, ORG 1 and ORG 2). The two-factor solution strengthens the construct validity of the questionnaire (i.e., the question items retained measure what they intended to measure). Cronbach's alpha was recalculated for the two new scales, and the values were .771 and .623 respectively, indicating that the two new scales are reliable (i.e., consistent) measures of the two-factor solution of social-communication and self-organisation.

Table 7-8 Two-factor solution

Factor 1: Social-communication		**Revised alpha**
SOC 1 item -	*When I tag my images I try to use tags which will also be useful to other people*	**. 771**
SOC 2 item -	*I use tags which will help other people to find my images*	
COMM 1 item -	*I tag my images as a way of conveying information about the image*	
Factor 2: Self-organisation		**Revised alpha**
SELF 1 item -	*I tag my images for my own personal use*	**.623**
ORG 1 item -	*I tag my images in order to place them into categories*	
ORG 2 item -	*I tag my images in order to group them together around common themes (such as event, location, date)*	

The two-factor solution supports much of the early work on tagging, which claims that tagging is either done for self or social reasons (Hammond et al., 2005; Marlow et al., 2006; Miller & Edwards, 2007; Van House, 2007; Cox, Clough, & Marlow, 2008) and social-communication is the strongest motivation for tagging images on Flickr (with a revised alpha score of .771), closely followed by self-organisation (with a revised alpha score of .623).

7.4 How do users tag the images they upload to Flickr

Out of the 456 valid respondents, 434 (95.17%) also said they would be happy for their tag data to be analysed in conjunction with the answers they gave to the questionnaire. However, from these 434 respondents: 16 had not given their screen names so their NSID identifier could not be obtained, and hence none of their tag data; 21 had no publicly available images; 16 had images available, but had not tagged any of them; and 17 of the respondents had deactivated their accounts in between when they completed the questionnaire and when the API was used to retrieve their tag data. This therefore left a final sample of 364 Flickr users from which to base the tag classification on.

7.4.1 Tag classification

For each of the 364 Flickr users, 10 of their most recently uploaded image URLs were retrieved (or as many as were available if they did not have 10) along with five random tags for each of the images (or as many tags as were available if five had not been assigned). The API call methods used were: **flickr.people.getPhotos** and **flickr.tags.getListPhoto**. This resulted in a total of 3,462 unique image URLs, with a total of 12,832 accompanying tags.

The image URLs were stored in one column of a spreadsheet, and for each image URL, the accompanying tags were stored in adjacent cells on the same row as that of their corresponding image URL. Clicking on the URL opened up the page that the image was located on in Flickr. Each image was examined, and then using the tag classification scheme as outlined in Table 6-2 the tags were classified according to their relationship with their accompanying image.

The vast majority of respondents (91.5%) had one tag category that the majority of their tags fell into (see Table 7-9). The remaining 8.5% of respondents had a mixture of two and three different tag categories that they tended to use equally. Overall, category A1 (what the image is 'of' – generic) was the most popular, with 22.82% of all of the tags classified falling into this category. Tag categories B1a and C1 were the second and third most popular choices.

Table 7- 9 Overall percentage of the various tag categories

Classification Category		Overall Percentage of Tags	Percentage
A1	Tag generically identifies what image is 'of'	22.82%	22.82%
B1a	Tag specifically identifies what image is 'of' (place names/events)	35.51%	18.56%
B1b	Tag specifically identifies what image is 'of' (people/animals)		4.76%
B1c	Tag specifically identifies what image is 'of' (inanimate objects/gadgets/brands)		2.08%
B2	Tag identifies what image is 'about'		10.11%
C1	Tags relating to techniques/methods	11.99%	11.99%
D1	Refining tag	21.21%	4.76%
D2	Self-reference tag		11.75%
D3	Tag which denotes ownership		1.40%
D4	Compound tag		3.30%
E1	Misspelling	8.75%	0.12%
E2	Unable to determine relationship		0.17%
E3	Foreign word/character		8.46%

Krippendorff's alpha coefficient of inter-classifier agreement was 0.85. Since this is over 0.8, it is an acceptable level of reliability (Krippendorff, 2004).

7.5 Inferential analysis

The main aim of this thesis was to investigate users' claimed motivations for why they use Flickr and why they tag their images to see what effect these motivations have on the types of tags that they use. Sub-questions were developed to add additional context to the relationship between motivation to upload and tag and tagging practice (i.e., the age and gender of the Flickr user, number of images, groups, contacts etc.).

The dependent variable (DV) was the overall tag type that the Flickr users had been assigned to, based upon the classification of their image tags, and the aim was to investigate how the various independent variables (IVs) affected a respondent's preferred tag type. Since the DV was nominal (i.e., respondents had been assigned to a category), and also since the DV consisted of more than two possible categories (i.e., the tag classification included: A1, B1a, B1b, B1c, B2, C1, D1, D2, D3, D4, E1, E2, E3), the most appropriate statistical test to use in order to investigate the relationships between the DV and the IVs (with the IVs consisting of a mixture of nominal, ordinal, and interval data),

was multinominal logistic regression (Bull & Donner, 1987). Logistic regression was used to predict the probabilities of the range of IVs resulting in a particular category of the DV (Hilbe, 2009, p. 385).

Hosmer and Lemeshow (1989) advise that variables should have a minimum of 10 cases per category for logistic regression. Categories with low frequencies mean that there isn't enough data spread within the data set, which means that the interaction between the variables can't be successfully investigated. In such instances it is accepted practice to reduce the number of categories or to combine categories into logical groupings so that all categories have adequate data coverage.

7.5.1 Refining the content analysis scheme (motivation to upload)

As discussed in section 7.2 of the results chapter, whilst it was interesting to look at the split of subcategories that accounted for people's motivation(s) for uploading their images to Flickr, the results became unwieldy when looking at the split of subcategories for respondents with two and three motivations resulting in a large spread of different combinations of subcategory groupings, each with a very small percentage of respondents who were assigned to that particular subcategory(s) grouping combination. The subcategories were therefore merged into their overall motivation category in order to create more meaningful results (e.g., D1, D2, and D3, became category D: social-communication).

However, after merging the subcategories, there were still some combinations of motivations that had low frequencies (e.g., 'A B & C', 'A B & D', 'B C & D'). It was not logical to merge any of these categories as each of the four motivations were distinct and it was the grouping of motivations that was the issue rather than the categories of motivations themselves. It was also impractical to remove those cases from the regression with a low frequency, as this would have resulted in the removal of a large proportion of the data. Therefore in order to investigate the relationship between motivation to upload and tagging, the four overarching motivation categories were treated as binary, and each respondent was coded as either having a particular motivation present or not, (i.e., someone motivated equally by a combination of A B and C, would be coded as having A,

B, and C present, and D not present. This resulted in an overall frequency count of the number of times each of the motivations had been stated.

16 respondents had been assigned to motivation category E (unable to classify). These 16 respondents were removed from the regression that specifically looked at the relationship between motivation to upload and tagging practice because their motivation could not be interpreted in any way. However, these respondents could be included in all of the other regression analyses as it would not be necessary to know their motivation when investigating what effect factors such as age, gender, and number of contacts had on tagging.

7.5.2 Refining the tag classification scheme

Similarly to people's motivations for uploading their images to Flickr, there were a number of respondents (n=31) who had an overall tagging practice that was evenly split between a number of different tag types (e.g., the tags they used were split between categories A1, C1, and D2), and this resulted in a number of tag combinations that had a frequency of less than 10 respondents. Rather than delete these 31 cases from the analysis, an additional 10 images (or as many as were available if there were not 10) was retrieved for each of the 31 respondents, and five accompanying tags per image (or as many tags as were available if there were not five). Classifying a larger sample of the respondents' tags may reveal one clear tagging strategy, and this may help to reduce the number of tag groupings that had a low frequency of respondents.

The additional classification overcame the problem of low frequency tag combinations and all respondents were found to have one clear tagging practice. However two tag categories still had a frequency of less than 10 respondents each.

- Tag category B1c (what an image if 'of' – specific: inanimate objects): only two respondents used this category as their overall tagging practice.
- Tag category D3 (denotes ownership): only three respondents used this category as their overall tagging practice.

In order to overcome this problem, all of the B1 subcategories were merged (B1a, B1b and B1c all became B), and all of the D subcategories were merged (D1, D2, D3, and D4 all

became D). The E subcategories were not included in the final analysis as these subcategories covered foreign word tags, misspelt tags, and also those tags that were unable to be classified. It was therefore not appropriate to investigate potential relationships for tags that could not be interpreted by the researcher.

After simplifying the classification scheme for regression and after removing categories E1, E2 and E3, a total of 39 respondents were removed from the final analysis, leaving a final sample of 325 Flickr users.

7.5.3 Multinominal logistic regression

There are different options available for entering independent variables into a logistic regression model, namely, simultaneous entry, or stepwise direct entry (Swanson & Holton, 2005, p. 125). Simultaneous entry involves all of the variables being entered into the model at once and non-significant variables then being removed from the model, and the stepwise direct entry method builds the regression model in a sequential manner where variables are tested one by one, and those that are found to be significant are retained in the final model (Shtatland, Cain, & Barton, 2001). Whilst the same outcome is typically produced by both approaches (Shtatland, Cain, & Barton, 2001), the stepwise method is best suited when the number of independent variables is sufficient that it would make comparing them all at the same time confusing (Swanson & Holton, 2005, p. 125). Therefore the stepwise method was used in this investigation due to the fact there were 14 independent variables: motivation to upload (self-organisation, self-communication, social-organisation, social-communication), motivation to tag (factor 1: social-communication, factor 2: self-organisation), gender, type of photographer, continent of origin, pro account status, number of groups, number of contacts, number of images, and age.

7.5.3.1 Sample differences

The overall final sample referred to throughout the results chapter is made up of three different samples of Flickr users (i.e., random, 2010, and Twitter). Whilst the aim of this thesis was not to look for patterns, similarities, or differences between the three subsamples, a logistic regression analysis was nonetheless performed prior to the main

analysis to determine any significant differences between the samples so that any potential bias in the results could be determined.

However, testing for differences between three groups across a large number of independent variables would run the risk of increasing the familywise error rate, and this is where the probability of a type 1 error (i.e., a false positive) is raised due to the fact a large number of comparisons are being made simultaneously. In such instances, the Bonferroni correction method should be applied to the analysis (Hair et al., 2006, p. 384). This is a method whereby the critical alpha level is lowered using the formula *k(k-1)/2* (where k is the number of groups or conditions). In this analysis, the significant alpha level was therefore lowered from .05, to .017. Utilising the adjusted p value of .017, the logistic regression found that the sample of Flickr users recruited via Twitter had 49% more contacts than the 2010 sample (p value .011) and 7% more contacts than the random sample (p value .015).

However, the regressions showed that there was no relationship between motivation to upload, motivation to tag, age, gender, country of origin, type of photographer, or pro account status of the three different samples. An additional regression was performed on the sample of Twitter users, to determine if there was a significant relationship between number of contacts and tagging practice, however no relationship was found (p value .206).

The remaining analyses resumed the normal critical p value of .05.

7.5.3.2 The relationship between motivation to upload and tagging

From the final sample of 325 Flickr users, the 16 respondents that had been assigned to motivation category E (unable to classify) were not included in this regression, leaving a total of 309 respondents.

Overall, motivation to upload was not found to have a significant relationship with tagging practice (p value .087), however motivation A (self-organisation), was found to be significant (p value .040), and respondents who were motivated by self-organisation were 16% more likely to tag using category D tags. This relationship was significant at the

p<0.05 level. The null hypothesis was accepted for the motivations of self-communication, social-organisation, and social-communication, and rejected for self-organisation.

The remaining regressions (unless otherwise stated) included all respondents apart from those that had been assigned to tag category E (n=325).

7.5.3.3 The relationship between motivation to tag and tagging

This regression included the total final sample of 325 respondents. Using the two-factor solution as developed in the factor analysis, factor 1 (social-communication) and factor 2 (self-organisation) were treated as ordinal level independent variables and the regression was used to investigate if there was a relationship between either of the factors and tagging practice. There was found to be no overall relationship between either of the motivation factors and tagging practice (p value .409). The null hypothesis was therefore accepted.

7.5.3.4 Gender

No respondent had skipped this question therefore the final sample in this regression consisted of 325 respondents. The regression showed that there is a significant relationship between gender and tagging (p value .009) at the p<0.01 level. Males were more likely to adopt a B1 (i.e., tag specifically identifies what image is of) (p value .042) (<0.05) and a C1 (i.e., tags relating to techniques and methods) (p value .013) (<0.05) tagging strategy than females. Males were 1.3% more likely to use tag category B1 and 2.2% more likely to use tag category C1 than females. The null hypothesis could therefore be rejected.

7.5.3.5 Type of photographer

No respondent had skipped this question therefore the final sample in this regression consisted of 325 respondents. There was found to be no relationship between the type of photographer a respondent classed themselves as and their tagging practice (p value .211). The null hypothesis was therefore accepted.

7.5.3.6 Continent of origin

Respondents came from a total of 56 different countries, many of which had only one respondent per country. In order to make the data more meaningful, countries were recoded into continents (as already presented in section 7.1.3 of the results chapter). However, three of the continents (South America, Africa, and Oceania) still had very low frequencies, and so these three categories were omitted from the regression analysis that investigated if continent of origin had an effect on tagging practice, leaving a final sample of 295 respondents. From the three continents that were investigated (Europe, North America and Asia) there was found to be no relationship between continent of origin and tagging practice (p value .509) and the null hypothesis was therefore accepted.

7.5.3.7 Pro account

As the data regarding the number of images a user had was collected via the use of the Flickr API there was no missing values for any of the respondents. This regression therefore consisted of 325 respondents. Whilst there was an overall relationship between pro account status and tagging practice (p value .044) significant at the $p<0.05$ level, the regression did not indicate the direction of the relationship between pro account status and tagging. The null hypothesis was therefore rejected, and the original research hypothesis was accepted at the two-tailed level.

7.5.3.8 Analysis of interval level variables (age, number of contacts, number of groups, and number of images)

Before the multinominal logistic regression could be performed on the IVs that consisted of interval level data (i.e., age, number of contacts, number of groups, and number of images), it was necessary to first of all consider outliers and skewed data, as outliers can have a big influence on regression (Dancey & Reidy, 2004, p. 405). Regression should reflect the 'average' subject, not unusual cases (Dancey & Reidy, 2004, p. 405).

From the descriptive statistics section of the results and the box plots, there was evidence of skewed data relating to: the number of contacts a user had; the number of groups a user was a member of; and the number of public images a user had. Skewed data should first be

checked to see if there have been any errors in data collection or input (Vaughan, 2009, p. 107). However, in relation to the three specific elements of skewed data outlined above, there had been no obvious error in data collection as it was perfectly feasible for a Flickr user to have a large number of contacts, groups, and images. Whilst some literature suggests deleting extreme outliers from the analysis (Dancey & Reidy, 2004, p. 405), this was not appropriate in this instance since the distribution was so heavily skewed. Deleting such a large number of respondents from the final analysis would have risked losing valuable insights into the relationships that were being analysed. In order to overcome this problem, the responses for number of contacts, number of groups, and number of images were log transformed. Log transformation is a method for normalising a distribution that is positively skewed (i.e., has a long right tail). Log transformation can only be applied to numbers above 0, and as the mode average for both the number of groups and the number of contacts a respondent had was 0, +1 was added to all respondents with a value of 0.

7.5.3.8.1 Number of groups

No respondent had skipped this question therefore the final sample in this regression consisted of 325 respondents. There was found to be no relationship between the number of groups a user was a member of and their tagging practice (p value .133). The null hypothesis was therefore accepted.

7.5.3.8.2 Number of contacts

No respondent had skipped this question therefore the final sample in this regression consisted of 325 respondents. A relationship was found between number of contacts and tagging practice (p value .020) and for every one unit increase in the number of contacts a user had they were 5.3% more likely to tag using the C1 tagging category (i.e., tags relating to techniques and methods). This relationship was found to be significant at the $p<0.05$ level. The null hypothesis was therefore rejected.

However, the fact that the sample of respondents recruited via Twitter were found to have 49% more contacts than the 2010 sample and 7% more contacts than the random sample is likely to have contributed to this finding.

7.5.3.8.3 Number of images

As the data regarding the number of images a user had was collected via the use of the Flickr API there were no missing values for any of the respondents. This regression therefore consisted of 325 respondents. A relationship was found between the number of public images a user has and their tagging practice (p value .026) and for every one unit increase in the number of images a user had they were 4.7% more likely to tag using the C1 tagging category (i.e., tags relating to techniques and methods). This relationship was found to be significant at the $p<0.05$ level. The null hypothesis was therefore rejected.

7.5.3.8.4 Age

Only one respondent had skipped the question concerning age, this regression therefore consisted of 324 respondents. As the data for age was not badly skewed, this regression was performed without investigating for any outliers. The regression showed that there is no relationship between age and tagging (p value .705), the null hypothesis was therefore accepted.

7.5.3.8.5 Final model

Taking the independent variables that were found to be significant during the process of stepwise direct entry regression, the variables that were included in the final regression model were: motivation to upload (self-organisation); number of contacts; number of images; gender; and pro account status. These variables were simultaneously entered into the logistic regression model, and they were found to have an overall p value of .010.

The five variables are therefore significant at the $p \leq 0.01$ level in being able to predict the tagging practice of Flickr users.

7.6 Summary

Descriptive statistics indicated a representative spread of males/females, age ranges, country of origin, kind of photographer, and pro account status. Whilst the data relating to number of groups, contacts, and images is highly skewed, this was not an unusual finding and the data was log transformed to assist with analysis.

Most respondents had one or two main motivations for uploading their images to Flickr, and social-communication (social signalling/attention) and social-organisation (sharing, maintaining relationships, and group memory) were the two most popular motivations.

Factor analysis suggested a two-factor solution for explaining motivation to tag images, and this indicated that social-communication and self-organisation were the two main motivators, with the items in the questionnaire that related to these two motivations being reliable measurements.

The vast majority of respondents (91.5%) were initially found to have one tag category that the majority of their tags fell into and category A1 (what the image is 'of' – generic) was the most popular tag type with 22.82% of all of the tags classified falling into this category.

Multinominal logistic regression provided a deeper understanding of how the various independent variables affected tagging practice, and a summary of the findings relating to whether or not the hypotheses developed in section 4.3 of the research design chapter is presented in Table 7-10.

Table 7-10 Hypotheses summary

			Notes:
H1	There will be a relationship between motivation to upload images to Flickr and tagging practice	**R***	*Respondents motivated by self-organisation 16% more likely to tag using D category (P<0.05) (i.e., refining tags, self-reference tags, tags denoting ownership, and compound tags)
H2	There will be a relationship between motivation to tag images in Flickr and tagging practice	**R**	
H3	The number of groups a user is a member of will affect their tagging practice	**R**	
H4	The number of contacts a user has will affect their tagging practice	**A**	For every 1% increase in the number of contacts a user had they were 5.3% more likely to tag using the C1 tagging category (p<0.05) (i.e., tags relating to techniques and methods)
H5	The number of public images a user has will affect their tagging practice	**A**	For every 1% increase in the number of images a user had they were 4.7% more likely to tag using the C1 tagging category (p<0.05) (i.e., tags relating to techniques and methods)
H6	Age will affect tagging practice	**R**	
H7	Gender will affect tagging practice	**A**	Males were 1.32% more likely to use tag category B1 (i.e., tags that specifically identify what the image is 'of') and 2.2% more likely to use tag category C1 (i.e., tags relating to techniques and methods) than females (p<0.01)
H8	The kind of photographer a user classes themselves as will affect tagging practice	**R**	
H9	Country of origin will affect tagging practice	**R**	
H10	Whether or not the user has a pro account will affect their tagging practice	**A**	Supported at the two-tail level (p<0.05)

(A: hypothesis accepted R: hypothesis rejected)

8 Discussion

In this chapter, issues specific to the methods and results are discussed in relation to the main research aim of comparing motivation to upload and tag images in Flickr with tagging practice in order to assess the strengths and weaknesses of the investigation, and the potential for the results to be generalised. The chapter begins by discussing the potential bias in the three subsamples that were used. Possible reasons for the low response rate to the questionnaire are then examined, along with issues specific to the design and results of the questionnaire. The chapter then moves on to discuss the overall findings, and concludes with a summary of what the results mean for image uploading and tagging in Flickr.

8.1 Method considerations

8.1.1 Potential sample bias

In order to minimise sample bias and reach a representative sample of Flickr users a random probability sample from the full population of Flickr users was selected via the use of a bespoke Python program that acted as a random number generator in creating potential Flickr NSID identifiers. The program interacted with the Flickr API in order to check if the identifiers created were valid Flickr users. This random method meant that the sample of users selected was not biased in favour of people who had recently joined Flickr, or people who had uploaded lots of images, and it was also not biased in terms of demographic information. A total of 3,000 random users were sent the questionnaire URL via the Flickrmail message service. However, due to the initial low response rate, only those Flickr users that had actively used their accounts within the last year (i.e., 2010) were then selected and sent the questionnaire URL, and in this way, an additional 5,500 Flickr users were sent the questionnaire URL. A third subsample of Flickr users was also recruited to complete the questionnaire via Twitter.

Whilst the 2010 subsample was still a random selection of Flickr users that had actively used their accounts within the last year, it may have biased the sample towards users who were newer to the system and perhaps therefore more likely to have not fully explored the potential of Flickr in order to have realised exactly why it was of use and value to them.

Whilst information such as when a user created their account was not obtained, the number of contacts a user had was retrieved, and this was found to vary significantly between both the 2010 and random sample, and also with the Twitter sample. The Twitter sample was found to have 49% more contacts than the 2010 sample, and 7% more contacts than the random sample. The fact that the difference between the Twitter and the 2010 sample is so large (49%) supports the assumption that the 2010 sample is more likely to have consisted of Flickr users who had more recently created their Flickr accounts, and thus had not had the time to build up their list of contacts. However, this difference could also be indicative of the fact that the Twitter sample is more likely to have consisted of users who are embedded within the practice of using web 2.0 and social media sites, and are perhaps therefore more likely to have a larger number of contacts that reflects some of the networks they have on different sites. However, no differences were found between the three subsamples in terms of their reasons for using Flickr, or their motivation to tag (see section 7.5.3.1). There were also no significant differences found with regards to demographic information such as age and continent of origin (see sections 7.5.3.6 and 7.5.3.8.4).

Yahoo! (2012) reports that the most prominent demographic of Flickr users are males in the 18-34 age bracket. The sample in this investigation was 62.1% male, and just over half of the entire sample was in the 20-34 age bracket. This also supports the findings of Hargittai and Walejko (2008) who assert that males are more likely to engage in sharing content online. The results in this investigation indicate that the sample utilised was apparently a representative sample of the overall mix of Flickr members as reported by Yahoo!, thus strengthening the ability for the results to be generalised.

However, it is important to bear in mind that across all three subsample pools, it could be that Flickr users who are motivated to use the system for social-communication are generally more social people and are therefore more proactive in responding to requests to complete questionnaires compared to those Flickr users who are motivated more by self-organisation and self-communication. This would be classed as non-response bias on behalf of those motivated by self-organisation and self-communication (Oppenheim, 1992, p. 106). This could have contributed to why the motivation of self-communication was not found to be popular in this investigation. Ames and Naaman (2007) also found that self-communication was not a popular motivation in relation to using Flickr.

The questionnaire did not stipulate that respondents had to be English speaking, and as many of the questions were closed in nature and required either a number to be entered or a tick box to be checked, as long as respondents could understand English, then they could complete the questionnaire. Therefore all of the descriptive statistics relating to variables such as age, gender, and number of contacts included the data from all respondents regardless of their geographic origin. Those respondents that had used a language other than English to complete the free-text question explaining why they upload their images to Flickr were classified using category E of the content analysis scheme (unable to classify), as translating text can generate errors due to inexact translations. However since seven out of the 35 respondents' motivations that could not be classified had given an answer that was as a result of the ambiguous question wording (see section 7.2), only 28 respondents out of the total 456 respondents had answered in a foreign language. However, many respondents who stated they were from countries that would indicate their first language was not English nonetheless answered the questionnaire in English. This meant that for those that gave their permission for their tag data to be extracted as part of the final analysis, there were a total of 38 respondents that had foreign tags assigned to their images, and these respondents were excluded from the inferential analysis due to the problem of inexact translation.

8.1.2 Low questionnaire response rate

From the initial random sample of 3,000 Flickr users that were sent the questionnaire URL, only 22 responses were received (response rate = 0.73%). This was lower than the response rates for similar web-based Flickr questionnaires (Nov, Naaman, & Ye, 2009a, 2009b). Research by Prieur (2008) found that 39% of Flickr users are totally inactive, and 23% of registered Flickr users have totally private accounts. From the 22 survey responses that were received from the initial 3,000 that were sent out, 19 were from Flickr users who had all been actively uploading in that year (i.e., 2010). From the overall sample of 3,000 users that were initially sent the questionnaire, only 10% had Flickr accounts that had been active within the last year. Targeting the questionnaire URL to random Flickr users who had been active in the last year was therefore the most logical next step. In this approach a further 5,500 Flickr users were sent the questionnaire URL, however only 312 responses were received (response rate = 5.67%). The questionnaire URL was also advertised via Twitter, and whilst it is impossible to know how many potential people will have seen the questionnaire URL, a further 125 responses were received. Overall, 456 valid responses

were received, and whilst the target sample size of a minimum of 300 responses had been achieved and surpassed, the low overall response rate is nonetheless a concern.

Nov, Naaman and Ye (2009a, 2009b) report two similar studies of the same web-based Flickr survey where they sent a questionnaire to a random sample of 2,740 and 1,840 Flickr users respectively who had at least one publicly viewable image, and they received a total of 422, and 276 valid responses respectively (a 15.4% and 15% response rate). However, in both published versions of their study they reported having only sent their web survey to pro account users, and thus users who were perhaps more likely to be active in checking their account (considering they have paid to use the service). They also limited their survey to people who had had their accounts for at least three months. However, in this thesis investigation, limiting the questionnaire to only pro account users was decided against as this may have biased the sample towards users who were perhaps more interested in having a larger storage space for their images and therefore potentially more likely to be motivated by self-organisation. This could have also biased the sample towards Flickr users who were financially better off. Whilst the cost of a pro account is relatively low, it is nonetheless a recurring annual cost and will prevent or at least deter some people from subscribing. Dotan and Zaphiris (2010) found that users in Iran stated that the cost of pro accounts was a limiting factor to them, although this was in part due to the state sanctioned ban on Flickr, and the fact that PayPal does not accept payments from Iran. Whilst an attempt was made to specifically target Flickr users that had actively used their accounts within the last year (i.e., 2010), no additional restrictions were added to this filter, such as having to have a minimum number of publicly viewable images. Limiting the sample to only those users with public images might have biased the sample against those users that were motivated to use the system for self-organisation or self-communication, as these users might have been more likely to keep their images private, as well as users motivated by social-organisation who only wanted to share images with selected contacts. It could have also been the case that the 'activity' carried out within the last year by the user could have been very minimal; perhaps with only a few images having been uploaded, and it could still have been possible that although a user might have used their account 11 months ago for example, they had nonetheless more recently became an inactive member. In trying to be as inclusive as possible in order to increase the likelihood of reaching as random and varied sample of Flickr users as possible, it seems that this impacted negatively on the response rate. However, Nov, Naaman and Ye's (2009a) more targeted

approach resulted in a sample that was equally split between males and females and the average age of their respondents were 36 years in both of their web questionnaires. Thus their more targeted approach resulted in a sample that was slightly less representative of the wider Flickr community.

The prize incentive may have also contributed towards the low response rate of the questionnaire, despite the fact it was intended to try to increase it. Wright (2005) advises that internet users are bombarded with spam and bogus emails on a daily basis, and as such users become desensitized and often unable to differentiate between messages from valid and credible sources and those from more 'questionable' origins. Receiving an unsolicited request from someone (in some cases on the other side of the world) to complete a short questionnaire and be entered into a prize draw for the chance to win a prize may have set off alarm bells in the minds of many Flickr users when they received the questionnaire URL causing them to think it was spam. In order to minimise this risk, the questionnaire included accompanying text that gave comprehensive details about the researcher and the project, with links to the research group's website in order to further establish the credibility of the request. However, this required the respondent to read through the accompanying text, and perhaps in many instances the respondents decided to just delete or ignore the request having only read the first few words (Oppermann, 1995). There is often a general apathy for people viewing web content to fully read what they are viewing (Couper, 2000), and people may have been especially wary if they read the sentence explaining that they had the chance to win a prize. Whilst offering a prize might increase the likelihood of people trying to complete the questionnaire more than once, this was only found to be the case for three questionnaire responses, which is relatively low.

There is also a possibility that the Flickr user did not notice the request that had been sent to them via Flickrmail. Flickr users have the option of being notified via an associated primary email address when someone adds them as a contact, invites them to join a group, or when someone sends them a personal Flickrmail message. However users can opt out of this notification alert, in which case, unless they regularly log in to their Flickr account, then the questionnaire request that was sent to them could have easily sat unnoticed for a long period of time (this is supported by the fact a few people did send Flickrmail messages to the researcher after the questionnaire deadline had passed apologising for not having picked up the request sooner). Or, perhaps a large proportion of the users that had

opted in for receiving the notification alerts had linked their Flickr accounts to an email addresses that they did not check very often or to an address they did not use anymore.

8.1.3 Questionnaire design and results

8.1.3.1 Open-ended question

The questionnaire included an open-ended question that asked respondents to 'briefly explain why you upload your images to Flickr.' A few respondents answered this question in terms of why they use Flickr specifically, rather than some of the other image management and sharing applications (e.g., 'I use it because it is free and easy to use'). It is clear in retrospect to see how this question was not worded explicitly enough and thus caused confusion and ambiguity to some of the respondents. Whilst the pilot study questionnaire had given respondents the chance to provide feedback on question wording, the respondents that took part in the pilot study did not necessarily pick up on the ambiguous wording of this question, or if they did, had not been proactive in highlighting it. However, all respondents in the pilot study answered this question in the manner it was intended, therefore it is likely that the respondents in the pilot study did not find this question overly ambiguous. Nonetheless, in the principal investigation, only seven people's motivations for using Flickr out of the total 456 respondents had answered in a way that indicated they had either misread this question or found it confusing.

8.1.3.2 Likert scale statements

The questionnaire included a 5-point Likert scale that consisted of a series of eight statements that had been designed to measure motivation for tagging images in Flickr. Respondents were asked to indicate to what extent they agreed/disagreed with the statements (1 – strongly agree / 5 – strongly disagree). Each statement was intended to measure one of the four individual elements that made up the four proposed overarching constructs of motivation as identified by Ames and Naaman (2007) in the literature review (i.e., social-communication, social-organisation, self-communication, self-organisation), and there were two question statements per element, each worded slightly differently. Two statements were created for each element as Oppenheim (1992, p. 147) and Schwab (1999, p. 35) argue that a questionnaire should not rely on single questions when it comes to measuring the attitudes that are most important in the study. Asking the same question in a

number of different ways is seen as a way of ensuring that what is being asked can be reliably measured.

However, it is not always easy to ask the same question in many different ways, and a series of repetitive questions is likely to annoy the respondent and cause them to lose interest in the questionnaire and to either just answer in the way that they think the researcher wants them to answer, or they may just answer in an arbitrary way. As the statements in this Likert scale related to very specific issues, only two statements per motivation were asked and it was also thought that this would reduce the risk of respondents losing interest in the questionnaire. However, all of the statement pairs were initially found to have low Cronbach's alpha reliability scores, and this was partly attributable to the fact there were only two items being measured in each pair. Much of the literature advises that alpha increases in size when the number of items in a scale increases (Gliem & Gliem, 2003; Hair et al., 2009, p. 137) and so high Cronbach's alpha scores should be treated with caution. However, Hair et al. (2009, p. 102) deem that the lower level of acceptability for alpha scores is .60, therefore in this investigation the scales relating to self and communication (with Cronbach's alpha scores of 0.235 and 0.464 respectively) did not have internal consistency. Combining the pairs together with their various corresponding pairs was also found to result in low Cronbach's alpha scores for the motivations of self-organisation and self-communication (with Cronbach's alpha scores of 0.481 and 0.136 respectively). A factor analysis was therefore conducted to further investigate how the questionnaire statements related to each other.

The factor analysis revealed problems both with one of the statements measuring the construct of 'self', and also with one of the statements measuring the construct of 'communication'. The SELF 2 item ('when I tag my images I do not think about how useful the tags will be to other people') was negatively worded, as highlighted by the factor analysis, which indicated that respondents answered very differently on the two 'self' items. Whilst it is not a bad thing to have a mix of positive and negatively worded questions, the particular wording of this question meant that it ended up asking something slightly different to what had been intended. Rather than asking if tagging was done for self reasons, the question essentially ended up asking if the respondent *was not* driven by social reasons. This wording meant that the question loaded negatively onto the social-communication factor. Similarly, the factor analysis revealed that the COMM 2 item ('I tag

my images as a way of enhancing what is contained in the image') had very little in common with the other items in the Likert scale, and on closer inspection, this question was asking something different to what had been intended. Whereas the COMM 1 item was asking about 'imparting information', the COMM 2 item was essentially asking about 'subtly changing information'.

The pilot study did not reveal these problems with question wording and that can be attributed to the small sample size (n=33).

8.1.3.3 Two-factor solution

In light of the problems with the SELF 2 and COMM 2 questionnaire items, the factor analysis suggested the removal of the COMM 2 and SELF 2 items, and proposed a two-factor solution, indicating that social-communication and self-organisation were the two most predominant motivations for Flickr users tagging their images. These two proposed factors consisted of three questionnaire statements each, with revised alpha values of .771 (social-communication) and .623 (self-organisation) indicating that they are reliable measures of the two-factor solution.

Including more statement items per motivation would have helped to counteract for the fact that certain items were removed from the scale, and it would have helped to increase the likelihood of achieving more favourable alpha values from the outset.

Whilst the results of the factor analysis proposed a two-factor solution for what motivates users to tag their images in Flickr (i.e., social-communication and self-organisation), it is important to acknowledge that the factor analysis only indicates that these are the two most important and coherent constructs rather than being able to prove conclusively that they are the most important and coherent constructs. Responses to questionnaire scales are largely dependent on the scale itself, and the same set of respondents answering a different questionnaire with a scale designed to measure the same thing could potentially produce a different outcome. Also, the inclusion of more questionnaire statements per construct, and, the inclusion of questionnaire items that were not ambiguously worded, would have counteracted for the potential effects of the removal of any items from the final solution, and this could have resulted in a different factor solution to the one that was proposed.

8.1.4 Automatically extracted Flickr tags

In order to identify how users tag their images in Flickr, 10 of the most recently uploaded image URLs (or as many as were available if there were not 10) were retrieved for 364 of the Flickr users that completed the questionnaire, along with five random tags for each of the images (or as many tags as were available if five had not been assigned). There are two main concerns here: whether or not up to 10 images per user, and up to five tags per image, was a large enough number to be able to get a representative insight into the overall tagging practice of users; and, whether or not extracting 10 of the most recently uploaded images biases the sample of images. Flickr users often upload images in batches, with batches of images that often relate to the same event or topic. Images that are related to the same event or topic are therefore likely to also have similar, if not identical tags. This means that it is not possible to know if the tagging practices that users were assigned to were merely a result of the 10 images that had been extracted for them all being related to the same event or topic, or whether or not they would have been assigned with that tagging practice anyway if a more random sample of 10 of their images had been extracted. The five tags that were extracted per image were random tags, but it is unclear to what extent users vary the types of tags they use per image. For instance, if a user has two images with a selection of tags each, and the user is found to have an overall C1 tagging practice (i.e., tags relating to techniques and methods), was this because the first image was predominantly tagged using C1 category tags, or because both images had just enough C1 tags to indicate an overall predominance for C1 tags. In selecting five random tags from the first image, the impression would be that the user had a C1 tagging practice, but if only selecting five random tags from the second image, slightly more B1a tags (i.e., tags specifically identifying what image is 'of' – place names/events) might have been collected, thus giving the overall impression of a B1a tagging practice. The specific images and tags that are looked at are therefore highly likely to influence the tagging practice that a user is assigned as having, and this could change depending on the selection of images and tags looked at. The only way to counteract for this variation is to look at a large enough sample of images and tags per user, and it is very difficult to estimate what the most appropriate number is, in order to give a representative impression of a user's tagging practice. However as this investigation was looking at a large sample of Flickr users (n=364), up to 10 images per user, with up to five tags per image resulted in a total of

3,462 unique image URLs, with a total of 12,832 accompanying tags, all of which were classified manually by the researcher. This was a time consuming process, and it would have been impractical to significantly increase these numbers further.

8.2 Analysis of the results

8.2.1 Motivations to upload images to Flickr

The free-text question asking people to briefly explain why they upload their images to Flickr resulted in respondents giving a mix of different reasons as to why they use Flickr and a content analysis scheme consisting of eight subcategories (grouped into four overarching motivations) was developed in conjunction with the literature. Whilst the majority of respondents gave one main reason for their use of Flickr, some respondents gave two and in some cases three reasons for why they upload their images. For some respondents, the different reasons they gave belonged within the same overarching category of motivation, and for other respondents, their reasons belonged to a mixture of different overarching motivations. Whilst this allowed for a rich qualitative insight into people's motivations, it also meant that analysing and quantifying the responses became a little unwieldy resulting in many motivation groupings with low frequencies. In order to make the analysis more meaningful, the subcategories were merged so that it was easier to see the overall groupings of the four main motivations. Whilst this problem could have been avoided from the outset by asking respondents to only state their main primary reason for uploading their images, this would have resulted in a picture that was only presenting half of the truth, as it would not have taken into account that people's motivations for using a system can be the result of a combination of different reasons. However, in order to perform the logistic regression investigating the relationship between motivation to upload and tagging practice, the motivations were treated as binary categories as there were some category combinations that had low frequencies thus making them unsuitable for logistic regression. This approach is positive in the sense that categories that each represented a distinct motivation did not have to be merged with other categories that they did not logically fit with, and it is also positive as no cases were removed from the analysis on the basis of having a low frequency. However, it meant that only the four overall categories of motivation could be investigated, rather than any of the motivation combinations (i.e., self-

organisation coupled with social organisation – which was the fourth most popular motivation).

The content analysis of why people upload their images to Flickr found that social-communication and social-organisation were the top two motivations, and a large number of respondents reported either one of these or a combination of the two as their main reason(s) for uploading images. These two motivations both link back to Deci and Ryan's (1985) extrinsic motivation theory and the fact that behaviour can be driven by: the desire to improve skills (Lakhani & von Hippel, 2003) for example to gain comments and feedback from other Flickr users on how to improve photography skills and technique; to enhance professional status (Lakhani & Wolf, 2005) for example to use Flickr as a place to showcase photography work; or to build reputation within the community (Nov, Naaman, & Ye, 2009b) for example to share images with friends, family, or unknown contacts. Yet despite the two social (or extrinsic) motivations being the most popular motivators in uploading images to Flickr, it is interesting to note that the mode average of respondents (which constituted 15.6% of the total sample of respondents) were not a member of any groups in Flickr. Stvilia and Jörgensen (2010) also found that 37% of their sample of Flickr users did not belong to any groups, and Negoescu and Gatica-Perez (2008) reported that 50% of Flickr users do not post images to groups. Whilst groups are seen as indicators of social presence (Negoescu & Gatica-Perez, 2008; Negoescu et al., 2009), Cox, Clough, and Siersdorfer (2010) suggest that there is a lot of Flickr activity that is not centred on groups and that only committed users join groups. Social motivations do not therefore have to be synonymous with group membership.

Self-organisation tended to be mentioned in conjunction with another reason rather than on its own, indicating that self-organisation is perhaps a secondary activity, seen as an 'added bonus' or perhaps used as a 'secondary backup' facility rather than a primary one. Despite Flickr providing secure and private storage for images, it is clear that people are drawn to it more for the social and sharing avenues that it provides. As Ames et al. (2010) postulate, 'if people want to archive their images, then maybe they are much happier to do so on a site that has no public sharing options available.' Perhaps people find the different privacy level options that are available in Flickr confusing, and so opt to use a different system instead if their main purpose is for that of secure storage and backup.

Self-communication was found to be the least popular motivation, with only 45 people out of the total sample mentioning this as a reason as to why they upload their images. Flickr is well known for its community and social aspects, and so similar to the discussion regarding why self-organisation was not a popular motivating factor, perhaps people who want to upload their images online to aid with personal reflection and memory do not perceive Flickr to be the most appropriate place to do so. Perhaps people that are motivated by self-communication are much more likely to upload their images to a personal blog, or to one of the popular microblogging platforms such as Tumblr or Posterous. Although such platforms are marketed as sharing platforms, they are increasingly being used as personal scrapbook style applications (McAdams, 2011; Point, 2012) due to the ease with which users can seamlessly upload content directly from their smartphones, along with accompanying text, titles, and tags. The microblogging nature of these platforms mean that the content uploaded is displayed as a post with a date entry, making it easy to scroll through content and see exactly when it was added. This format therefore provides the perfect platform to aid with memory and personal reflection, especially as posts can be made private, and people's accounts can also be password protected. This is in quite stark contrast to Flickr, where although users can add lengthy notes and descriptions to images, the images are displayed in a format of either five or 18 images per page, and the individual images have to be clicked on in order to see the accompanying description and tags that go with the image. These factors could therefore discourage users from utilising Flickr for the purpose of self-communication. Additionally, the fact that people take more images on cameraphones now means that people have a 'ready made' photo album at hand to look at whenever they like for the purposes of self reflection and this could also go some way to explaining why self-communication is not popular on Flickr. It could also be that these images are seen as more 'throwaway' and transitory; useful in the short term but not viewed as being worth uploading online for secure storage or sharing.

8.2.2 Motivations to tag images in Flickr

As already discussed, respondents' motivations for tagging their images in Flickr was investigated via a 5-point Likert scale that consisted of a series of eight statements that had been designed to measure motivation for tagging images in Flickr. Respondents were asked to indicate to what extent they agreed/disagreed with the statements on a scale of 1 - 5 (1 – strongly agree / 5 – strongly disagree). The factor analysis suggested a two-factor

solution for motivation for tagging images in Flickr, indicating that social-communication and self-organisation are the two predominant motivators for tagging, and this deviates from Ames and Naaman's (2007) four overarching tagging motivations.

The motivation of self-communication was not found to be a popular reason for tagging images in Flickr, and this is supported by the findings of Ames and Naaman (2007) who also found that self-communication was not a popular motivation for tagging images. However, the motivation of social-organisation was found to be the second most popular reason for uploading images to Flickr, and it is therefore surprising that social-organisation is not a factor in terms of motivation to tag images. Whilst the two-factor solution is a reliable and valid interpretation of the results, the underlying instrument (i.e., the Likert scale) has to be treated with caution with regards to the responses it generated in terms of the weaknesses with some of the question statements as discussed in section 7.3.2. Nonetheless it is necessary to discuss the possible reasons for these findings beyond the limitations of the Likert scale and what these findings mean for image tagging in Flickr.

The traditional purpose of tagging is generally thought to be to describe and organise content (Smith, 2008, p. 5; Chu, 2010, p. 30), so it seems logical that images that are intended for sharing with other people would be tagged based on the motivation of social-organisation as well as social-communication. However, the motivation of social-communication can in many ways be thought of as a self act rather than a social act. As although the Flickr user wants their images to be found and viewed by others, they are essentially motivated by the benefits they will personally receive from having their images viewed. Thus the motivation for tagging is therefore only ever a self based act (i.e., for self-organisation, or for the self-based act of social-communication). Images that are uploaded to Flickr for the true purpose of sharing in a social way (i.e., for social-organisation) therefore suffer from the fact that people do not know how to tag for this purpose. After all, describing resources is a subjective process, and this subjectivity is heightened with images compared to other resources such as links to research papers as images in Flickr tend to be more personally meaningful. Therefore people are likely to feel unsure as to how they tag for the benefit of others or may wish to avoid potentially annoying others due to the choice of tags, and therefore avoid doing so. It could therefore be the case that images that are intended for sharing are generally done so directly by the image uploader (i.e., perhaps they send the exact page URL for a selection of images to

friends and family) as it is quicker to upload the images to Flickr and then send personalised emails to a selection of different people with the image URLs, compared to having to upload the same images again and again to different emails. Perhaps orality also still plays a big role in sharing images with friends and family (Van House et al., 2004) meaning that people still prefer to verbally discuss the content of photographs that they have sentimental attachment to and hence tags do not tend to be used in this context.

8.2.3 How people tag their images in Flickr

Despite research that asserts that people do not bother to tag images as they find it an arduous and boring task (Heckner, Neubauer, & Wolff, 2008; Cox, Clough, & Marlow, 2008; Heckner, Heilemann, & Wolff, 2009; Stvilia, 2009) in this investigation the vast majority of respondents tagged their images (only 16 respondents from the final sample were found to not have any tags). However, it could have been the case that non-taggers had been put off from completing the questionnaire once they glimpsed through it and realised that there were questions relating to tagging.

Whilst the tag classification found that individual Flickr users make use of a range of different types of tags, people nonetheless had a particular tag type that they predominantly used and this was defined as their overall tagging practice. However, this assignation of tagging practice was based on the tag category that had the highest frequency count out of the respondent's 50 possible tags. This method of determining a person's overall tagging practice is coarse-grained and not all of the respondents were assessed on the basis of 50 tags. Some respondents only had between one and four tags available for some of their images, meaning that their tagging practice had been assessed on a smaller number of tags than those respondents who had the full 50 available. There is also the issue discussed in section 8.1.4 relating to whether or not up to 50 tags per user is a sufficiently large enough sample of tags to be able to determine a person's overall tagging practice.

Tag category A1 was found to be the most popular tag category overall and this encompasses generic keywords that describe what an image is 'of' (e.g., animal, car, house). This was in contrast to the preliminary study, *General patterns of tag usage among university groups in Flickr* (Angus, Thelwall, & Stuart, 2008), which found that B2 was the most popular tag category (describing what an image is 'about'). The B2 tag category

was found to be the fifth most popular tag category in the principal investigation. However the findings of the principal investigation are in line with research by Jörgensen (2003, p. 247) and Golbeck, Koepfler and Emmerling (2011) who claim that the generic (i.e., 'of') tag categories are those that tend to be used most frequently. No subject specific knowledge is needed to add tags of this level, and so it seems logical that this is the most popular tag category as it is the easiest to think of when looking at images. However, different user groups are likely to produce different results.

The C1 tag category was the third most popular choice. C1 tags relate to things such as the type of camera/film/lens used, technique, geo-tags, and automatically generated app tags. Automatically generated app tags are linked to smartphone apps such as Instagram and Hipstamatic. When a user of an app such as Instagram uploads an image to Flickr directly from the app itself, automatic tags are added to the image giving the app name, the camera filter that was added to the image, and also tags such as 'iphoneography' and 'square format'. This is similar to the EXIF (Exchangeable Image File) data that many cameras automatically embed in image files, which may include information relating to the date and time a photo was taken and the shutter speed that was used, however EXIF data is not automatically converted into tags in Flickr, whereas app data from smartphones is. Out of the 43 people (12% of the sample) that had a C1 tagging strategy, 13 of these Flickr users had a large number of machine generated tags, predominantly related to the Instagram and Hipstamatic apps, and also to services such as Shozu (a cameraphone app), and Foursquare (a location based social networking site for mobile devices). This further supports the prevalence of cameraphone photography as highlighted in the introduction and literature review chapters of this thesis. Whilst it could be said that users whose images predominantly have machine tags associated with them can't be investigated in the context of their tagging practice, due to the fact their tags have not been assigned by themselves, it is important to note however that the users who had images with machine tags associated with them had also assigned other tags to their images too rather than the images solely having machine tags assigned, and the 13 people who had machine tags is a small proportion of the overall sample of respondents. However, only those respondents who had an overall C1 tagging strategy were investigated for their use of machine tags, it is therefore possible there were many other Flickr users in the sample that also had machine tags assigned to their images, but such tags had been outweighed by the other types of tags that those users had assigned to their images.

The D3 tag category was found to be the least popular and this kind of tag is one that denotes ownership (e.g., a tag that is the Flickr username of the image uploader). This is in support of the work of Bischoff et al. (2008) who found that tags that denote authorship are not used frequently in web 2.0 services. In the case of Flickr, this is likely to be a consequence of the strong 'user identity' that accompanies Flickr user's profile pages. Users can add detailed biographical information to their profile page along with links to personal websites and contact information. The option for all of this contextual information to be included on a Flickr user's profile perhaps makes the inclusion of tags that specifically denote ownership redundant, as in Flickr it is very easy to identify the user that is connected to an image, even if other users arrive at the image through serendipitous browsing. It is therefore easy to understand why the D3 tag category is not a popular tag choice in Flickr.

It is also interesting to note that some respondents from non-English speaking countries had a mixture of foreign and English tags. This could have been for a number of reasons. Firstly, the person may have had an international mix of Flickr contacts and so used English tags as a way of being able to communicate aspects of the image with a wider audience so as to not exclude people (Dotan & Zaphiris, 2010). Secondly, if the image uploader was motivated to use Flickr for social-communication and wanted to attract attention to their images, perhaps they realised that they had a better chance of attracting a larger number of viewers to their images if they used tags that were also in English. Also, perhaps images with multi language tags were more likely to be those that related to specific geographic locations. So whilst a person may tag an image that was taken on holiday in England with tags in English that specifically relate to where the image was taken and any landmarks or cultural artefacts or icons contained within the image, tags relating to what the image was about (e.g., category B2 tags such as 'holiday', 'sightseeing') might have been more likely to be added in the language that was native to the uploader. It could also be the case that the English term used was one that has been subsumed into a different language because there is no native equivalent.

Males were found to be more likely to tag using both a B1 and C1 tagging practice than women. This finding supports the work of Argamon et al. (2003) who claim that males tend to adopt a more 'informational' approach in writing and talk in a more literal way

about objects, compared to females who tend to write in a more 'involved' manner regarding the association between objects. The B1 tag category (what an image is **of**) is the factual description of items contained within an image, and this therefore corresponds to the description of the literal 'objects' (whether animate or inanimate) contained in the image. Similarly, the C1 tag category (technique, camera model, film used etc) corresponds with the 'informational' approach that males tend to adopt, thus providing specific information about the technical aspects associated with the image.

8.2.4 The relationship between motivation to upload and tag and tagging

The sample of respondents that were used to investigate the relationship between motivation to upload and tag, and tagging practice was a considerably smaller sample of respondents than had been included in the sections of the questionnaire that reported on the overall reasons why people upload and tag their images in Flickr. A smaller sample of respondents was used to investigate the relationship between motivation to upload and tag, and tagging practice, for a number of reasons: firstly, not everyone gave their permission for their tag data to be compared with the responses they gave to the questionnaire; secondly, a number of people could not be included in the final analysis because either their tagging practice had been unable to be determined, they had no publicly available images, they had publicly available images but had not tagged any of them, or they had deactivated their accounts since completing the questionnaire. This meant that from an initial sample of 456 valid questionnaire responses, only 309 were included in the comparison of motivation to upload and tagging practice, and only 325 were included in the comparison of motivation to tag and tagging practice. Whilst these figures still exceed the initial requirement of having a minimum of 300 respondents, it is nonetheless still a big disparity in figures. It could be the case that those respondents who did not want their tag data to be analysed were more likely to have tagged in a particular way, although as only 22 respondents did not want their tag data to be analysed, it is unlikely that such a small number of respondents would have affected the results dramatically. Whilst tag data is publicly available via the Flickr API, and hence the tag data for these respondents could have been collected without the respondents' permissions, given that image and tag data was being analysed in relation to specific answers that had been given as part of the questionnaire, it would be unethical to extract the data without first obtaining the

respondents' permission. Nonetheless, this smaller final sample size does not compromise the ability to be able to generalise from the final results due to the fact the analysis was conducted on a random representative sample of the Flickr population.

In order for the relationships between motivation to upload and tag, and tagging practice to be investigated, some of the categories in the tag classification scheme had to be merged. There is a fine balance to be had between creating a classification scheme that has too many categories that no meaningful relationships can be investigated and creating a scheme with so few categories that there is no richness to the data gathered and any nuances are lost. In excluding the three E categories (E1: misspellings, E2: unable to determine, E3: foreign word/character) there were 10 remaining categories in the tag classification scheme developed in this thesis. In merging some of the categories so that regression could be performed, this selection of 10 categories was further reduced down to five categories (see section 7.5.2). However this was done in a logical way and the overall distinctions between the various categories were retained. Category A1 (what an image is of at the generic level) remained as a category by itself. Categories B1a, B1b, and B1c all related to describing what an image is of at the specific level (i.e., some subject knowledge is needed in order to assign the tag), for instance, an image of the Christ the Redeemer statue in Rio de Janeiro in Brazil requires a familiarity with what the statue looks like and its location, in order for the tags 'christ the redeemer' and 'rio de janeiro' to be applied to it. Whilst each of the three B tag categories had a different subject matter (i.e., B1a related to place names/events, B1b related to people/animals, and B1c related to inanimate objects), they were all nonetheless intended to describe what an image is of at the specific level, and therefore merging these three categories together into an overall B1 category was a logical step. Category B2 (what an image is about) remained as a category by itself, as did the C1 category (tags relating to camera model/film/lens, technique, app, geo-tag, machine tags). The D category tags (D1: refining tags, D2: self-reference, D3: tags that denote ownership, D4: compound tags) were all merged together into an overall D category as all of these subcategories related to tags that were predominantly only useful to the image uploader rather than other users of Flickr. Merging these four subcategories was therefore a logical step. The refinement of the tag classification scheme resulted in the loss of some richness in the data but it was performed in a logical way and the overall distinctions between the categories were mostly retained despite some of them being merged. Without merging the categories, the relationships between motivation to upload

and tag, and tagging practice could not have been investigated as the spread of data between the various categories was too thin in some cases and therefore rather than deleting those categories that had low frequencies and thus reducing the data set, categories were merged instead.

Despite some of the interesting findings with regards to what motivates Flickr users to upload and tag their images and also with regards to how Flickr users tag their images, there was little overall correlation between the two. Only the self-organisation motivation for using Flickr was able to predict tagging practice, and users with this motivation were 16% more likely to use category D tags than those who were not motivated by self-organisation. Tag category D encompassed: D1 (refining tags), D2 (self-reference tags), D3 (tags denoting ownership), and D4 (compound tags). It therefore fits that those users motivated to use Flickr for personal search and retrieval are more likely to use tags that are personally meaningful (e.g., self-reference tags) or refining tags (e.g., tags consisting of a number, letter, acronym or date). If the images uploaded are intended for personal archival, then the tags applied to those images don't necessarily have to 'make sense' to anyone other than the person who uploaded the image. Refining tags that consist of numbers are also often indicative of batches of photos that are uploaded together in one session. Numbers are often added to such groups of images as it is easier than taking the time to think of tags that specifically relate to what the image is *of* or *about*. Users may also add numbers to images in the first instance with the intention of going back at a later date and adding more context, and either the user never gets around to this, or, they just leave the number tags alongside subsequent new tags that they add rather than deleting them.

The lack of a relationship between motivation to upload and tag, and tagging practice indicates that tagging is on the whole carried out in relation to the specific content and purpose of the individual image rather than in relation to the overall motivation that the user has for both uploading the image to Flickr and their perceived motivation for tagging it. The tagging practice of a Flickr user seems to therefore be highly dependent on the specific images in question, rather than the user adopting one particular overall tagging strategy. The only exception to this was Flickr users motivated to upload for self-organisation. Tagging in relation to specific images rather than in relation to overall motivation would suggest that it would be harder to pinpoint a user's tagging practice due to the fact they are likely to use a range of different tag types. However, it could be that

certain users are more likely to upload images of a particular type, and therefore their tagging practice would be consistent in relation to the particular type of image content that they upload.

An interesting finding was that the more contacts and images a user had, the more likely they were to tag using the C1 tag category (tags relating to camera model/film/lens, technique, app, geo-tag, machine tags). A potential reason for this could be that the users with more contacts and images were more likely to be camera enthusiasts or passionate about photography. Such users are therefore more likely to use tags that relate to things such as camera model/lens/film or the kind of technique that was used to create the image. Whilst the logistic regression did not show any correlation between the kind of photographer that a user classes themselves as and their tagging practice, it could be that the three categories of photographers that were suggested in the questionnaire were either just not the most appropriate choice of categories or just did not pick up on the finer granularity in the kinds of photographer that may exist. Whilst someone may be a very keen enthusiast about using a particular type of camera or a particular kind of effect and would hence tag a lot of their images using the C1 tag category, they may not class themselves as a serious amateur due to their perception of their own skill level. However such a person is likely to nonetheless have a high number of images and also perhaps a high number of contacts due to their interest or enthusiasm for a particular niche area or aspect of photography. Linked to having a high number of images it also seems logical that a user with a pro account (and thus a larger storage capacity) is also likely to use a C1 tagging strategy, however this correlation could only be supported at the two-tailed level. So whilst it is possible to say that pro account does affect the kind of tags that a person uses, it is not possible to say in what way exactly it affects the kinds of tags that are used. It may also seem logical that a person who is a member of a large number of groups in Flickr would also fall into the category of users with a predominance of C1 tagging practice, but as discussed earlier in the chapter, group membership may no longer be seen as a worthwhile activity. Also, as the subject topic varies from group to group, the kinds of tags that are assigned to images in different groups by the same user may vary across groups. For a user that has particular interests in certain niche areas or for certain photographic equipment/techniques, it also seems likely that group membership will reach a saturation point. Beyond this saturation point there are likely to only be a certain number of groups that fulfil the criteria of the user, or, the user may not see the worth in being a member of a

large number of groups and would rather focus on quality of interaction in a smaller number (i.e., quality rather than quantity). The fact that males were found to be more likely to use a C1 tagging practice than women could also be linked to this as camera enthusiasts have traditionally tended to be males and may therefore be more likely to use C1 tags that encompass the description of camera models/films/lenses etc.

8.3 Summary

Despite social-communication being the most popular reason for both uploading images to Flickr and for tagging images in Flickr, there is an underlying 'selfishness' in both of these instances, and this can be related back to the extrinsic motivation drive as proposed by general motivation theory. In terms of motivation for uploading images to Flickr, the D1 subcategory was the most popular reason, and this reason encompasses social signalling and attention. Flickr is being used in order to draw attention to the images that have been uploaded, from either other photographers or like-minded people so that feedback and comments can be received perhaps giving advice on how the images can be improved on, or perhaps just giving praise of how good the images are. So whilst this motivation is social in the sense it is about sharing the images with other people, it is essentially a somewhat selfish act, as rather than wanting to share the images so that other people can enjoy or make use of them, they are being shared so that the uploader can benefit from the response they generate. It therefore follows that whilst tagging is associated with social-communication (the most popular reason for uploading images to Flickr), it is also associated with self-organisation (despite self-organisation not being a popular primary reason for uploading images to Flickr). Tagging motivation is therefore closely linked to personal motivation rather than for truly social reasons. Tagging practice however, relates more specifically to image content and aspects relating to the image itself rather than to the motivations that the user has for uploading and tagging it.

9 Conclusion

9.1 Introduction

The main aim of this thesis was to compare users' motivations to upload and tag their images in Flickr with how they tag their images in practice. This chapter summarises the extent to which this aim has been met and provides the overall findings from the investigation. This chapter also discusses the contribution to knowledge that the thesis makes in both a theoretical and practical context, as well as the limitations of the findings, and some possible avenues for future research are proposed.

9.2 Summary of methods used to meet the research aim

Comparing users' motivations to upload and tag images in Flickr with how they tag their images in practice was achieved via a number of different methods. Motivations to upload and tag images in Flickr were identified via the use of a semi-structured questionnaire completed by a sample of 456 Flickr users. Whilst there was a slight element of bias found in the three different subsamples of respondents that completed the questionnaire, this was not found to affect the overall results, and the overall sample of respondents were found to be apparently representative of the global population of Flickr users. Identifying how users tag their images was achieved via the use of a manual tag classification scheme applied to tags automatically extracted via the Flickr API. The classification of tag data extracted automatically from Flickr minimised the effect of common method bias, and this is where the same instrument is used to measure both the DV and IV(s). Multinominal logistic regression was used to identify what effect motivation to upload and tag had on the types of tags users assign to their images, thus answering the main research questions of the thesis. This statistical procedure was also used to determine the effect that a number of additional variables had on tagging practice, and these additional variables related to the sub-questions of the thesis, and thus the sub-questions were also answered via the statistical techniques applied.

As the research design chapter reasoned, investigations that look at human beliefs and behaviours are generally best suited to case study and survey approaches. Whilst a case study would have provided a greater depth of knowledge into why people upload and tag

their images in Flickr, such an approach would have limited the number of Flickr users that could be investigated. As Flickr has a global user base of 51 million members (Yahoo, 2012), a case study approach would have severely limited the ability to generalise the results. This investigation therefore utilised survey methodology with the goal of being able to generalise the findings to the wider Flickr population. A bespoke Python program that interacted with the Flickr API was used in order to pick random Flickr users, these users were then sent a semi-structured questionnaire via the Flickrmail internal mail system. An additional approach utilised Twitter for recruiting respondents. Whilst the scale of the questionnaire was limited by an overall low response rate, the combination of the approaches in recruiting Flickr users nonetheless yielded responses from an apparently representative sample of 456 Flickr users, thus allowing for the results to be generalised to the wider global user base of Flickr members. However, caution is always needed when generalising results from surveys. Questionnaires suffer from a number of disadvantages including the fact that respondents may lie or answer in the way they think the researcher wants them to answer. Whilst a number of steps were taken to minimise the potential drawbacks of using a questionnaire, data can nonetheless only be retrieved from those people that are motivated to complete the questionnaire in the first place. This is termed as non-response bias (Oppenheim, 1992, p. 106), where the answers from those that did respond to a questionnaire may differ from the potential answers of people who did not respond to a questionnaire.

9.3 Summary of the findings

Flickr users who completed the questionnaire tended to state one clear motivation for uploading their images to Flickr and social-communication (uploading to gain comments and feedback on one's work and to attract attention from other Flickr users) was the most popular reason, closely followed by social-organisation (uploading images for the purposes of sharing, maintaining relationships, and to aid with group memory). For those respondents that indicated two or three reasons for uploading images to Flickr, self-organisation tended to be mentioned in conjunction with another reason, indicating that whilst the social aspects of Flickr may be the key motivation, the additional benefit of having images securely stored and backed up online is an added advantage, and therefore often a secondary motivation. Self-communication was found to be the least popular

motivation for uploading images to Flickr and this finding was in line with the research of Ames and Naaman (2007).

Factor analysis indicated that there are two predominant motivations for tagging images in Flickr rather than the four predicted by Ames and Naaman (2007). The two predominant motivations are social-communication and self-organisation. The motivation of social-communication is slightly more important to users than that of self-organisation, and this corroborates with the conclusion that self-organisation is a secondary reason for uploading images to Flickr, as an added bonus to the primary motivation of social-communication. The fact that motivation to tag was not associated with social-organisation (which was the second most popular reason for uploading images to Flickr) indicates that people perceive tagging as a self-beneficial act, even if they are motivated to upload images for the purpose of sharing. This conclusion is further consolidated by the realisation that the motivation of social-communication is in fact a somewhat selfish act. Users motivated by social-communication are concerned with their images being found and viewed for their own personal benefit rather than for others to necessarily benefit from viewing the image.

From the classification of users' tags, the vast majority of Flickr users had one clear tagging practice. Category A1 (describing what an image is of at the generic level) was the most popular tag type and this tag type can be seen as being useful to both the image uploader and the wider Flickr community. The regressions indicated that both motivation to upload and motivation to tag did not have a significant effect on the types of tags that users assign to their images, with the exception of the self-organisation motivation. Users who were motivated to upload their images to Flickr for self-organisation were more likely to use category D (self-reference) tags, which is reflective of their underlying motivation of self-organisation. The lack of a relationship between motivation to upload and tag, and tagging practice indicates that tagging is dependent on the specific image in question rather than being related to the overall motivation that the user has.

Gender, number of contacts, and number of images were however, found to be significantly related to tagging practice. Males were found to be 1.32% more likely to use a B1 (i.e., tags specifically identifying what an image is 'of') tagging strategy and 2.2% more likely to use a C1 (i.e., tags relating to techniques and methods) tagging strategy than women. Flickr users with a higher number of images and contacts were found to be 5.3%

and 4.7% more likely to use a C1 tagging practice. Pro account status was also found to affect tagging practice.

This thesis has determined that whilst images can be uploaded to Flickr for a range of different reasons, tagging is more closely associated with either tagging for the self-beneficial act of having unknown Flickr users find and view images (social-communication), or for organisation and description for oneself (self-organisation). This finding reveals that Flickr users who are motivated to upload their images for the purposes of social-organisation do not associate tagging as being related to achieving this goal. Whilst the tags they use can nonetheless usefully describe the content of what is contained in an image, such tags do not necessarily aid with the motivation of social-organisation (i.e., uploading images to share and maintain relationships and group memory or for ad hoc photo pooling). However, tagging practice overall was found to relate more specifically to image content and aspects related to the image rather than the overall motivation of the user.

9.4 Contribution to knowledge

9.4.1 Theoretical contributions

This thesis investigation has found that users tend to have one main motivation for using Flickr, and social-communication is the most popular reason, closely followed by social-organisation. This finding supports previous research that has found that Flickr tends to be enjoyed for its social aspects (Van House, 2007; Prieur et al., 2008; Cox, Clough & Marlow, 2008; Cox, Clough, & Siersdorfer, 2010).

Two predominant motivations were found for tagging images in Flickr, and this finding deviates from the work of Ames and Naaman (2007) who proposed that tagging motivation is centred on four motivations (self-organisation, self-communication, social-organisation, social-communication). Social-communication and self-organisation were found to be the two predominant motivations.

Flickr users tend to have one overall tagging practice, and the most popular type of tag was found to be that which describes what an image is of at the generic level. This finding was

in support of the work of Jörgensen (2003) and Golbeck, Koepfler and Emmerling (2011) who also found this to be the most popular tag type in their investigations of images.

Whilst motivation to upload and tag was not found to significantly affect tagging practice, this finding led to the realisation that tagging in Flickr is not related to motivation, but instead is dependent on the content of the image. This finding contrasts to the body of work that reports that motivation for using a service such as Flickr and motivation for tagging images will directly affect tagging practice (Hammond et al., 2005; Marlow et al., 2006; Ames & Naaman, 2007; Zollers, 2007; Van House, 2007; Kennedy et al., 2007; Miller & Edwards, 2007; Thom-Santelli, Muller, & Millen, 2008; Heckner, Neubauer, & Wolff, 2008; Heckner, Heilemann, & Wolff, 2009; Körner et al., 2010; Strohmaier, Körner, & Kern, 2010; Kern, Körner, & Strohmaier, 2010; Zubiaga, Körner, & Strohmaier, 2011). This finding therefore corroborates with the original research rationale of this thesis investigation, which stated that tags should not be looked at in isolation, and instead should be viewed alongside the image they are attached to in light of the subjective nature of image interpretation.

This thesis has illustrated that whilst tagging is being used to describe image content and highlight aspects related to the image, tagging is not being fully used to assist in achieving the motivation behind image upload. This is an important contribution to the literature on tagging, and also to the field of personal information management within a web 2.0 environment. Whilst people are motivated to use a service such as Flickr for social reasons, and it seems that they want their images to be found and viewed by others, they are not fully utilising a key function of the service (i.e., tagging) to assist in achieving their overall motivation. Tagging is instead largely driven by the uploader's personal interpretation and relationship to the image. This finding also contributes to the field of human computer interaction in developing models and theories of interaction.

This thesis investigation also demonstrates that the work of the art historian Panofsky (1962, 1983) and the image indexer Shatford (1886, 1994) can be applied to image content in Flickr, of which a large proportion of image content is made up of personal photographs. Shatford (1986, 1994) rationalised that regardless of whether an image relates to the fine arts or the sciences, all images 'have attributes that can be categorised and generalised, based partly on the nature of images and partly on classification theory.' This

generalisation can now be further extended to include web 2.0 image content in Flickr, and this is an important addition to the fields of photography and new media.

9.4.2 Practical implications

The findings from this thesis investigation give rise to four important practical implications that can be of benefit to Flickr users, system designers, and other researchers.

1. The fact that Flickr is not being utilised for the purposes of self-communication should be seized upon by system designers. Outside of Flickr, self-communication is a popular aspect of current photographic practice, fuelled by the prevalence of cameraphones, and the ease with which images can be uploaded online. People are currently being drawn to rich content micro-blogging applications such as Tumblr, Posterous, and Pinterest. These services allow users to upload images and add notes and tags that are displayed in reverse chronological date order, making them effective diary substitutes and creating a space for personal reflection. However, people dislike information fragmentation and in having different content on different sites, ideally people would like to have one system that can satisfy the range of needs that they have. System designers could develop an integrated micro-blogging platform for Flickr, providing a one-stop shop for all photography related practices, as well as secure storage for the images uploaded.
2. Whilst social-organisation was found to be the second most popular reason for uploading images to Flickr, users were not found to be motivated to tag their images for this reason. Therefore users who are motivated to use Flickr for the purposes of social-organisation should be encouraged to also tag their images for this purpose, in order to provide better alignment between their motivations and actions. Whilst the tags they use may nonetheless be 'useful' tags and thus perfectly adequate for the purposes of describing and organising images for maintaining relationships and group memory or ad hoc photo pooling, there are two main issues of concern. Firstly, images that are related to photo pooling (i.e., images that were taken at an event such as a conference, workshop or wedding with the intent of sharing with people who were either present or absent) may sometimes be added to a group that has been specifically set up to house all of the images from that particular event. However, if rather than submit images to groups, people are encouraged to tag the images they take via the use of specific designated 'event'

tags - the details of which could be broadcast at the event (for instance on the closing slide of a keynote presentation at a conference) – then perhaps more attendees would be encouraged to share their images from the event as they wouldn't have to proactively seek out the information regarding what specific Flickr group to upload their images to after the event. This might result in a higher proportion of D1 tags for people motivated by social-organisation (i.e., refining tags such as acronyms). Secondly, Flickr should proactively encourage the tagging of images relating to maintaining relationships and group memory (social-organisation), highlighting that information can easily be forgotten if it is not attached to an image.

3. The refined tag classification scheme presented in Table 6-3 is a bespoke classification scheme for analysing the relationship between images and their accompanying tags in web 2.0 environments. No research has been published to date that specifically draws on both image interpretation and elements specific to web 2.0 images in order to produce a tag classification for web 2.0 images. Drawing on the work of Panofsky (1962, 1983), Shatford (1986, 1994), and Golder and Huberman (2006), and also by visiting a random selection of tags and images the classification scheme was developed and tested both in the preliminary study, *General patterns of tag usage among university groups in Flickr*, and as part of the principal investigation of the thesis. The classification scheme presented in Table 6-3 is therefore a new and original contribution to the field of image classification and tagging. Via the use of a second classifier in the principal investigation, the classification scheme was found to have a Krippendorff alpha reliability score of 0.85. A Krippendorff alpha score of over 0.8 is considered an acceptable level of reliability (Krippendorff, 2004). The classification scheme presented in Table 6-3 is therefore also a valid and reliable classification scheme that can be utilised by other researchers who are interested in investigating web 2.0 image tags.
4. The content analysis scheme presented in Figure 6-3 is a bespoke scheme for classifying Flickr users' motivations for uploading their images to Flickr. The scheme is based on the methodology of Krippendorff (2004); a priori coding was used: categories were established prior to the analysis based on various motivations identified in the literature, and additional motivations could be added to the scheme if necessary. The categories that were established prior to the analysis were based on the motivations put forward by Van House et al. (2004); Kindberg et al. (2005a,

2005b); Van House et al. (2005); Cox, Clough, and Marlow (2008); Nov, Naaman and Ye (2008) and Ames et al. (2010), and the four overarching motivation categories proposed by Ames and Naaman (2007) were used to group together the individual motivations for uploading images to Flickr. The content analysis scheme developed was tested in the principal investigation of the thesis and with the use of a second classifier the scheme was found to have a Krippendorff alpha reliability score of 0.89. A Krippendorff alpha score of over 0.8 is considered an acceptable level of reliability (Krippendorff, 2004). Therefore the content analysis scheme presented in Figure 6-3 is both an original and reliable contribution that can be utilised by other researchers who are interested in investigating motivations for uploading images in web 2.0 environments.

9.5 Limitations of the research

The discussion chapter outlined a number of limitations with this thesis investigation, and the impact that such limitations may have had on the results. Whilst the respondents in this investigation were found to be an apparently representative sample of Flickr users, the main limitations in being able to generalise the results is the difficulty in being able to sufficiently cross-reference motivation with tagging practice because of the large amount of data needed, as well as the overall limitations that survey methodology suffers from, such as non-response bias. Whilst the Flickr API provides a method for a large amount of data to be automatically extracted from the system, this was limited due to the need to also have respondents' answers to the questionnaire in order to cross-reference the data from the API. Survey methodology is generally at the whim of potential participants, and the low response rate to the questionnaire in this investigation limited the amount of data that could be analysed.

An additional limitation in this investigation is that motivation and tagging were only looked at in relation to Flickr. Whilst Flickr is the most popular of the image management and sharing applications currently available (Remick, 2010), there are nonetheless other services that people use for storing and sharing images, such as Picasa, Photobucket, and SmugMug. This investigation found that tagging relates to image content rather than motivation for using the service, but this may not necessarily be the case for other image

management and sharing applications and therefore the results do not necessarily generalise to other systems.

9.6 Suggestions for further research

Based on the findings of this investigation, the need for further research is clear. Suggestions for such further research include the following.

1. One of the main findings from this investigation was that one of the popular motivators for using Flickr (social-organisation) does not translate to people's perceptions about the benefits of tagging their images. Hence it would be useful to further explore this discrepancy to better understand the reasons behind why people do not perceive tagging as being related to this purpose. Is this because people generally rely on submitting images to groups rather than relying on tags? Or, do Flickr users prefer to directly alert people to relevant images (perhaps via email)?
2. The introduction and literature review chapters of this thesis discussed the prevalence of cameraphones within society and how their use is changing people's relationships to photography. Hence it would be interesting to investigate the differences between the tags that are applied to images taken on cameraphones compared to other cameras. Thus the focus would be on the device used for image capture, and how this might affect tagging.
3. It would be useful to investigate if motivation for uploading and tagging, and tagging practice varies across different image management and sharing applications (e.g., Flickr, Picasa, Photobucket, SmugMug). Understanding the possible differences between services would assist in determining to what extent the results from this investigation and future similar investigations can be generalised. It could also be the case that people have accounts with more than one service and use each one for slightly different reasons (e.g., Flickr for social reasons, and Picasa for self reasons). Would such differences be reflected in the tagging practice of users who have multiple accounts? Or would tagging still be primarily linked to image content rather than motivation for using the service? It may also be useful to look at how a user's tagging practice may change over time.
4. A key finding from this thesis investigation was that tagging in Flickr is more closely related to image content than motivation for using the service. A logical next step from this finding is to investigate image typologies in Flickr to determine

if certain types of images (e.g., landscapes, portraits, family scenes) always tend to have the same tags assigned to them.

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